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SPECIAL ARTICLES

New Problems Affecting Labor and Wages Arise to Complicate Stabilization of Industry ---- 35
By ANDREW M. ROWLEY

Administrator Ickes Accepts Invitation to International Petroleum Exposition ---- 36

Valuable Papers Before A. S. M. E. ---- 36

Bailing, Shooting, Tubing and Acidizing at Binger ---- 38
By L. G. E. BIGNELL

Large Majority of Industry Favors Ickes Bill ---- 39
By HUGH D. MALLON

Derrick on Specially Built Barge in Water Location ---- 40
By NEIL WILLIAMS

Present Construction Features Reconditioned Pipe and Protective Coatings ---- 41
By L. G. E. BIGNELL

Contracts Must Enable Refiner to Use Natural Gasoline Throughout Year ---- 42
By L. P. CALKIN

Small Refinery Tanks May be Mounted at Low Cost ---- 42
By DANIEL IRWIN

Mid-Continent Natural Gasoline Creates Problem in East 43
By HOWARD E. FELT

Octane Value of Light Hydrocarbons ---- 44
By F. B. NEPTUNE and H. M. TRIMBLE

News From Foreign Lands ---- 50

World Fair of the Oil Industry (Editorial) ---- 52

Federal Control Necessary (Editorial) ---- 52

Great Lakes Line Being Looped ---- 63

Tyler Meeting for Federal Control ---- 63

Derivation of Equivalent Length Formulae for Multiple Parallel Pipe Line Systems ---- 70
By WILLIAM G. HELTZEL

Air-Gas Compressor Characteristics ---- 82
By JOHN P. KLEP

Radiant Absorption Section Pipe Still Coils Fired With Oil or Gas Fuel With Air ---- 92
By CHARLES E. McCULLOCH

Molal Combustion and Graphs of Stack Losses Using Oil Fuel ---- 97
By O. F. CAMPBELL

Fouling Factors in Heat Exchangers ---- 104
By E. N. SIEDER

Retiring Thickness of Refinery Equipment ---- 109
By F. L. NEWCOMB

Effect of Diameter, Etc., of Tubes in Exchanger ---- 115
By B. E. SHORT and T. F. STACK

Rotary Pump Development in Fields Occupied by Reciprocating Units ---- 122
By R. J. S. PIGOTT

Selecting Electric Motor Equipment for Pipe Lines ---- 128
By W. H. STUEVE

Analysis of Direct Current Rotary Equipment and Steam Power ---- 132
By D. M. McCARGAR and OSCAR A. HAAS

Making Repairs on Heavy Duty Diesel Engines in Pipe Line Service ---- 138
By J. B. HARSHMAN

Program of A.P.I. Meeting at Pittsburgh, Pa. ---- 139

Uneconomic Operating Units Being Eliminated From Natural Gasoline Industry ---- 141
By W. T. ZIEGENHAIN

Personnel of Natural Gasoline Companies in United States ---- 142

1934 Survey of Natural Gasoline Plants in United States 153

Pipe Line Construction News ---- 168

Field Problems From Readers ---- 194
Edited by T. F. SMILEY

FIELD OPERATIONS

Late Fields ---- 63

West and North Texas ---- 64

Southwest Texas ---- 162

East Texas ---- 164

Oklahoma ---- 177

Kansas ---- 179

North Louisiana-Arkansas, Mississippi ---- 180

Gulf Coast ---- 182

California ---- 184

Eastern Fields ---- 186

Rocky Mountain Area ---- 187

Canada ---- 187

Michigan ---- 190

Central West ---- 190

REFINING AND MARKETING

Gasoline in Group 3 Experiences Sharp Rise and Then Seems Undecided Which Way to Go ---- 54
By T. F. SMILEY

New York Market ---- 55
By C. O. WILLSON

Refinery and Crude Prices ---- 56-57

Tank Wagon Markets ---- 58

Natural Gasoline Manufacture ---- 59

Chicago Market ---- 63

News for Petroleum Refiners ---- 66

Technical Questions Answered ---- 193
By C. K. FRANCIS, Ph. D.

GENERAL DEPARTMENTS

Natural Gas Developments ---- 195

Market Record of Oil Securities ---- 196

Personal Paragraphs ---- 198-199

New and Improved Equipment ---- 204-205

Index to Advertisers ---- 208

Refinery Section Starts on Page 54

Branch Editorial Offices

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New Problems Affecting Labor and Wages Arise to Complicate Stabilization of Industry

By ANDREW M. ROWLEY

DISAGREEMENT over proper wage differentials provided for in the code for the petroleum industry, added to labor difficulties becoming more pronounced further complicated the situation confronting the oil business during the past week. Coupled with the active opposition on the part of a rather small minority of the business against the administration's production control bill recently introduced into Congress, conditions are such that the industry is looking to Washington for definite steps to be taken quickly to clarify the atmosphere.

With the opening of the main consuming season for the oil industry it is unfortunate to say the least that problems which heretofore have never confronted oil companies should arise to handicap operations and prevent efforts being centered on getting back to a reasonably profitable basis. The business has never been troubled by labor difficulties and wages paid have ranked higher than in other lines of industry.

Opposition to the bill proposed by Harold L. Ickes, Oil Administrator, and introduced into the Senate by Senator Thomas of Oklahoma, may have the effect of preventing passage of this measure at this session of Congress unless the administration and others in favor of the measure get busy immediately and bring pressure to bear on Congress. It is understood the administration is doing all it can to get quick action on the bill but members of Congress feel there is not sufficient time in this session to hold hearings and get the bill approved by both houses.

Of interest to the entire producing branch of the business is the feat accomplished during the past week by the General Petroleum Corporation in drilling a test below 11,000 feet, the first time that depth has ever been reached in drilling in the oil industry. The company's test in the South Belridge Field in California, at latest reports, had a gas showing at 11,015 feet. Operations are being continued and the test will be carried deeper.

Gulf Coast operators were somewhat encouraged during the past week by more promising developments there. A new producing area was opened in Acadia Parish, La., while a wildcat in Jackson County, Texas had a fairly good oil showing, making some believe a new producing field had been opened there. A wildcat test in Freestone County, Texas, which had been attracting attention, showed considerable salt water and does not look promising. Latest developments in the Cayuga area in East Texas indicate the producing sand is quite thin although it may extend over a wide area. Operators feel the area will not show a very high recovery per acre.

Crude Oil Production in the United States

Estimated daily average production for the week ending May 5, and a comparison with previous week and one year ago, follows:

	May 5	April 28	May 6, 1933
Oklahoma—			
Oklahoma City	172,030	199,665	180,985
Seminole-St. Louis	72,280	97,825	88,615
Remainder of State	237,065	234,865	195,465
Total Oklahoma	481,375	532,355	465,065
East Texas—			
Lathrop	214,120	208,880	420,595
Kilgore	155,630	151,820	300,430
Joiner	138,840	135,450	283,415
Total East Texas	508,590	496,150	1,004,440
West Texas	137,765	132,565	161,254
North Central Texas	88,247	88,097	74,115
Texas Panhandle	57,852	58,762	47,009
East Central Texas	49,215	48,885	58,597
Gulf Coast—Texas	170,457	163,518	168,961
Southwest Texas	49,413	48,915	53,910
Total State of Texas	1,061,539	1,036,892	1,568,286
Kansas	130,845	129,900	117,140
North Louisiana	25,535	25,890	28,390
Gulf Coast—Louisiana	53,215	49,015	41,156
Arkansas	30,535	30,480	30,125
Eastern Fields (excepting Michigan)	97,800	98,700	105,000
Michigan	30,936	28,866	17,450
Rocky Mountain area	86,590	84,670	74,877
California—			
Santa Fe Springs	43,000	42,200	54,500
Long Beach	63,000	62,200	73,000
Playa Del Rey	9,500	9,450	11,750
Elwood	14,600	14,300	13,500
Kettleman Hills	54,400	61,000	56,250
Remainder of State	284,500	280,850	263,500
Total California	469,000	470,000	472,500
Total United States	2,467,370	2,486,768	2,902,539

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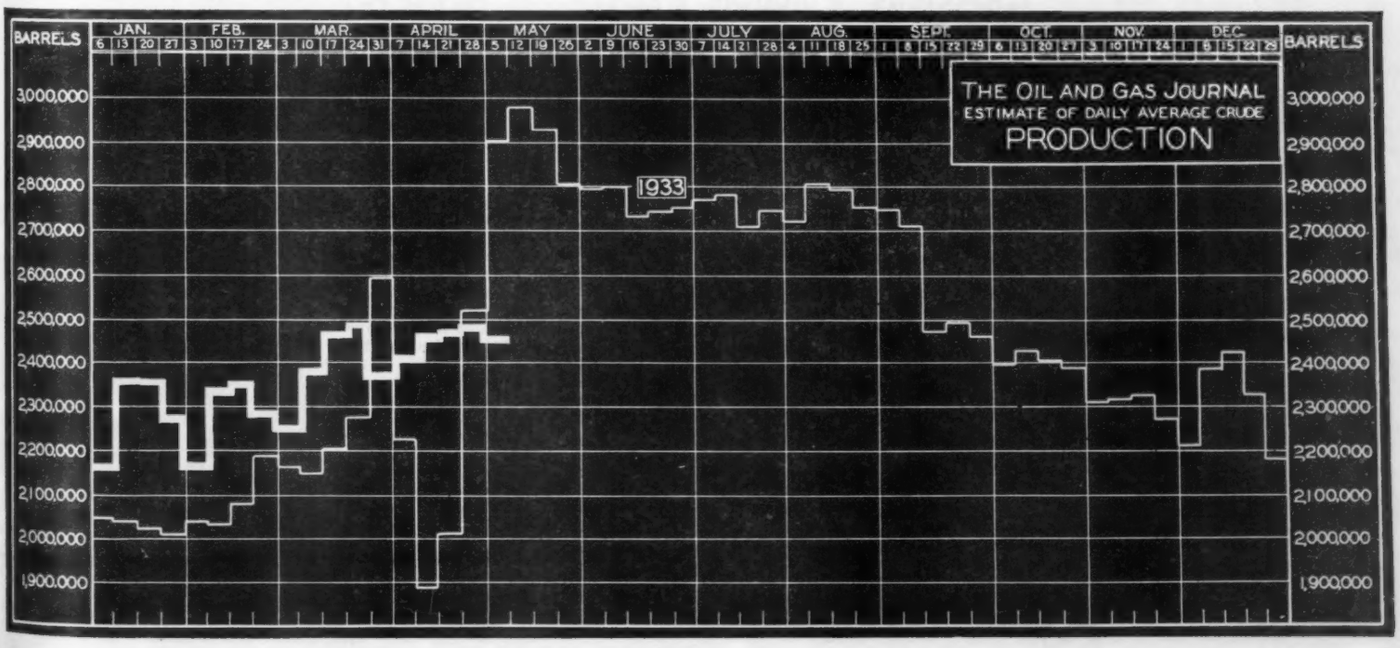


Oil Administrator Ickes Accepts Invitation to International Petroleum Exposition in Tulsa

Washington, D. C., May 8.—Harold L. Ickes, Secretary of the Interior and oil administrator, will arrive in Tulsa May 17 to attend the International Petroleum Exposition and Congress.

After a lapse of three and one-half years the International Petroleum Exposition will be again held in Tulsa May 12 to 19, inclusive. The exhibits will be

HAROLD L. ICKES

shown at the grounds used for former expositions near the Tulsa County Fair grounds in the southeastern portion of Tulsa. Most of the booths are in buildings especially built for exhibition purposes, although much of the heavy equipment is outside on the grounds under special sheds or tents.

This exposition was created to provide opportunity for an exchange of ideas and display of apparatus and equipment used in every department of the oil industry and has grown to an institution of international importance in the past 11 years. As the industry advances the apparatus and equipment used is improved and made more suitable for the duties to be performed.

A few years ago wells 4,000 feet in depth were common, now a hole more than 11,000 feet deep has been drilled and wells are producing from formations found at nearly 10,000 feet beneath the surface of the ground. Several major oil fields produce from formations below 6,500 feet and these conditions have imposed greater strains upon the equipment used in both drilling and pumping.

Pipe line transportation has advanced from the old steam driven pumps to automatic electric motor or Diesel engine driven stations with welded pipe lines. Automatic gathering systems are also in use in many fields, all of which has involved the development of special equipment and instruments that are being shown at the exposition this year.

In the refining department of the petroleum industry there has been a great advance made in all equipment and apparatus and special steels and alloys are now being used for high pressure, high temperature work that were unknown to the industry a few years ago.

The marketer has found many ways to improve the sale of his products and the manufacturers of special containers and dispensing equipment find an excellent opportunity to display their new products at this exposition.

This International Petroleum Exposition affords an opportunity for men in all branches of the industry to meet and exchange ideas and for technical societies to hold meetings to discuss their many problems.

New Exhibits

Conditions arising in the oil industry during the three and a half years have made a vast change in the industry and these are reflected in the txhibits of the 1934 show.

Exhibitors replying to a questionnaire sent out by the exposition said that 91 per cent of them had made improvements on their equipment and apparatus since the last show was held in 1930 and that 42 per cent of them had entirely new equipment and machinery which was not in existence in 1930.

Exhibits in the four major divisions of the industry show:

The production division will have a replica of the first oil well drilled by Col. Edwin Drake at Titusville, Pa., in 1859 and the tools used in bringing in this first "producer" drilled for oil. Beside this exhibit will be actual wells with modern derrick and rotary equipment capable of drilling 2 miles or more, in contrast with the 69½-foot depth of the Drake well. Many new inventions of auxiliary equipment used in surveying and checking on the condition of the hole are also on display.

An automatic pump station valued at $90,000 will head the list of exhibits in the transportation division. Many refinements have been made on this station since the last show, according to the members of the American Society of Mechanical Engineers who installed the station.

Many new devices to aid in refining crudes to provide better gasolines and oils to meet the requirements of the presmarketing division.

One of the most interesting developments in the oil industry has been the marketing division. An entire building is given over to these exhibits. The modern marketing end of the oil business began early in the century as a sideline to the grocery business. The old box and pump which had been at the rear of the grocery store where kerosene was sold was brought to the front and gasoline added. Later the drug store and automobile accessory firm placed gasoline pumps at the curb but gasoline was still a sideline business. Next, following the World War, the filling station came into its own with the drive-in type where gasoline and oils were sold exclusively. However, the trend of the past few years has been to add sidelines such as tires, batteries and even drinks and cigarettes. Thus, the trend to date has been to almost reverse the first gasoline station which was a side line to the grocery store. What the future station will be may be foretold in the exhibits at the exposition.

Educational Features

Several features of an educational and entertainment nature have been arranged. Sunday and Wednesday nights M. M. Kinley, oil and gas fire-fighting expert, will demonstrate how he puts out a blazing well with nitroglycerin. Two 84-foot wooden derricks have been built in front of the grandstand back of the

W. G. SKELLY
President

exposition grounds and gas piped from a high-pressure main a half mile away.

In honor of the seventy-fifth anniversary of the drilling of the Drake well and in honor of the foreign delegates, a pageant of oil, depicting the history of oil from Biblical times to the present will be presented Monday, Tuesday and Wednesday nights in the Fair Pavilion just outside of the exposition grounds. The Oil Capital Horse Show, headed by Frank Phillips, chairman of the executive committee of the horse show, will be held in the pavilion Thursday, Friday

(Continued on Page 61)

Especially Valuable Papers Prepared for Meeting of A. S. M. E. in Tulsa

W. B. WAY
General Manager

Papers of especial interest and importance to the refining, transportation and production branches of the petroleum industry have been prepared for presentation at the national meeting of the petroleum division of the American Society of Mechanical Engineers which convenes in Tulsa Monday, May 14 and continues through May 17. Sessions will be held in the clubroom of the Hotel Tulsa, and engineers from all sections of the country, including some national officers of the society will be present at the meeting. William G. Heltzel, general superintendent of the Stanolind Pipe Line Co., is chairman of the petroleum division.

Production men, refiners and pipe line operators, whether they be members of the A.S.M.E. or not, are invited to attend the sessions and, if they desire, to take part in the discussions of the different papers presented. Many men in Tulsa for the International Petroleum Exposition are expected to take advantage of the opportunity to listen to papers on subjects of great importance in the operation of the producing, refining and transportation divisions of the business and to the discussions on these papers. In order to stimulate this discussion, The Oil and Gas Journal is publishing in this issue, starting on page 70, papers which will be presented at the meeting.

Years of research are represented in the information and data contained in papers to be read at this meeting in Tulsa. As an example the paper prepared by Mr. Heltzel presents data and formulae based on more than five years of testing and checking. These formulae have been used in designing new pipe line systems and loops with great success under the most severe tests. Pipe line engineers believe the information contained in this one paper is worth hundreds of thousands of dollars to pipe line companies throughout the world.

The refining and production branches of the industry are well represented on the program and especially valuable data have been compiled by the speakers who will supplement their talks with lantern slide illustrations. The first session of the meeting will be devoted to refining and will start at 9:30 a. m., with W. L. Nelson of the University of Tulsa, presiding. B. E. Short of the University of Texas will preside at the afternoon session. Tuesday will be devoted to sessions on production and transportation will be the general theme at Wednesday's meetings.

A. W. LEONARD
Chairman Executive Committee

Program International Petroleum Exposition and Congress in Tulsa

PRE-EXPOSITION MEETINGS

Natural Gasoline Association Meeting, Tulsa, Okla., May 9 to 11 Inclusive. Hotel Tulsa

Opening Day of Exposition—Saturday, May 12

Directors of the Day: Clyde Alexander, W. S. Farish, S. A. Guiberson, E. R. Filley, Ernest H. Cornelius, Joseph R. McGraw, Ed H. Salrin, A. E. Bradshaw, and George A. Dye.

In Honor of: California, Los Angeles.
Pennsylvania, Oil City, Bradford, Titusville, Franklin.
University of Tulsa Petroleum School Day.
Chemists' Day.

10:00 a.m.—Exposition gates will open to the "World's Fair of the Oil Industry."

10:00 a.m.—Meeting of young oil students from all over the world at the University of Tulsa, School of Petroleum Engineering. Dr. R. S. Knappen, of the American Association of Petroleum Geologists, and N. V. Vannikoff, of the U.S.S.R., will address the students.

2:00 p.m.—Opening ceremonies of the International Petroleum Exposition, with assistance of American Legion, Joe Carson Post.
Band concert by Oklahoma A. and M. College band.
W. G. Skelly, president.
Invocation, Dr. George McDonald.
Address of Welcome, T. A. Penny, mayor.
Remarks by distinguished guests.

3:00 p.m.—Register of delegates from foreign countries at Exposition office.

4:00 p.m.—Register of "old-timers" of the petroleum industry in replica of old Drake well.

6:00 p.m.—Oklahoma Section of the American Chemical Society, special meeting at Sinclair Pennant Tavern.

8:00 p.m.—American Institute of Mining and Metallurgical Engineers, meeting at University Club. Dr. E. A. Stephenson, of the Missouri School of Mines, will speak on "Basic Data for Oil and Gas Well."

SUNDAY, MAY 13

Directors of the Day: R. C. Sharp, John M. Egan, H. V. Foster, D. F. McMahon, R. H. Bartlett, O. T. Dawson, Walter Gray, J. H. Brooks, Clyde Pape.

In Honor of: Montana, Great Falls, Billings.
New Mexico, Gallup, Roswell, Carlsbad
Ohio, Findlay.

1:00 p.m.—Exposition gates open.

3:00 p.m.—Demonstration of old method of drilling in front of old Drake well.

6:00 p.m.—Band concert by the Oklahoma Military Academy Band.

MONDAY, MAY 14

Directors of the Day: W. M. Bovaird, Jacob France, Robert F. Garland, William Holden, Walter Miller, J. Burr Gibbons, Warren C. Platt, Harry J. Morlang, Fred W. Insull.

In Honor of: Kansas, Wichita, Eldorado, McPherson.
Texas, Midland, Amarillo, Houston, Fort Worth, San Antonio, Kilgore, Tyler.
West Virginia, Sistersville, Clarksburg.

9:00 a.m.—Exposition gates open.

9:30 a.m.—Opening Session of the Petroleum Division of the American Society of Mechanical Engineers, Hotel Tulsa.

REFINING SESSION

"Retiring Thickness of Oil Refining Equipment," F. L. Newcomb, Standard Oil Development Co., Elizabeth, N. J.

"Application of Fouling Factors in the Design of Heat Exchangers, E. N. Sieder, Foster Wheeler Corp., New York.

"Heat-Transfer Rates on Condensing, Reboiling and Miscellaneous Heat Exchange Service," Max Higgins, Texas Co., New York.

"Friction in Baffled Tube Bundles," T. F. Stack, Gulf Refining Co., Port Arthur, Tex.

2:00 p.m.—A.S.M.E., afternoon session, Hotel Tulsa.

"The Use of A.S.T.M. Temperature-Viscosity Charts for the Blending of Lubricants," J. P. Calderwood, Kansas State College, Manhattan, Kans.

"Petroleum Fuels and Combustion Data," O. F. Campbell, Sinclair Refining Co., East Chicago, Ind.

"The Design of Radiant Heat-Absorbing Section of Pipe Still Coils," Charles E. McCulloch, Foster Wheeler Co., New York.

8:45 p.m.—Pagaent, "History of Oil," with cast of 500 depicting the story of the petroleum industry from Biblical times to the present, in Pavilion on grounds.

TUESDAY, MAY 15

Directors of the Day: Frank R. Billingslea, R. S. Ellison, A. F. Bourne, W. J. Morris, Waite Phillips, E. B. Reeser, Earl Sneed, H. C. Wiess, F. O. Prior.

In Honor of: Louisiana, Shreveport, Monroe.
Wyoming, Casper.
Kentucky, Bowling Green, Ashland, Owensboro.

8:00 a.m.—Exposition Golf Tournament opens at Tulsa Country Club, A. M. Bowman, chairman. Eighteen-hole qualifying rounds to determine members of flights for match play—sixteen each flight.

9:00 a.m.—A.S.M.E. Program continues at the Hotel Tulsa.

PRODUCTION SESSION

"Air-Gas Compressor Characteristics," J. P. Klep, University of Oklahoma, Norman, Okla.

"Dynamometers for the Study of Pumping Problems," Blaine B. Westcott, Gulf Research Co., Pittsburgh, Pa.

12:15 p.m.—Young Oil Executives entertained by Junior Chamber of Commerce at luncheon in Main Dining Room, Tulsa Building.
Traffic Club meeting, Mayo Hotel.

2:00 p.m.—Afternoon session, A.S.M.E., Hotel Tulsa.

"Gas-Electric Prime Movers for Rotary Drilling," D. M. McCargar, Allis-Chalmers Co., Tulsa.

"Oil-Field Rotary Pumps and Recent Developments," R. J. S. Pigott, Gulf Research Co., Pittsburgh, Pa.

Excursion for Transportation Men. Inspection of Stanolind Pipe Line Co.'s station at Hominy, Okla., leaving Hotel Tulsa at 1:30 p.m.

7:30 p.m.—Purchasing Agents Association meeting, Chamber of Commerce Room. Principal Speakers: Major Stiles.
M. Decker, representing the NRA administration in discussing the Suppliers Code, assisted by: G. A. Thompson, purchasing agent of the Empire Companies, at Bartlesville, who presents the buyer's view of the code. O. E. McClatchey, vice chairman of the Oil Companies Buyer's Group, will preside at the meeting.

WEDNESDAY, MAY 16

Directors of the Day: Wirt Franklin, W. S. Fitzpatrick, Ralph B. Pringle, J. S. Sidwell, R. C. Holmes, Ray L. Dudley, E. G. Bullock, Henry L. Phillips, Walter Fleming, O. C. Staples.

In Honor of: Oklahoma, Oklahoma City, Seminole, Drumright, Glenpool, Cushing, Fairfax.
Mississippi, Jackson.
New York, Olean, Corning.

8:00 a.m.—Golf Tournament, First round matches in all flights, 18 holes.

9:00 a.m.—A.S.M.E. Program continues at Hotel Tulsa.

10:00 a.m.—Stripper Well Associations of Eastern and Mid-Continent areas for purpose of forming national association, Mayo Hotel.

TRANSPORTATION SESSION

"Selection of Economic Electric Motor Equipment for Pipe Line Pumping Stations," W. H. Stueve, Oklahoma Gas & Electric Co., Oklahoma City, Okla.

"Major Repairs of Diesel Engines," J. B. Harshman, Stanolind Pipe Line Co., Tulsa.

2:00 p.m.—Annual Meeting of the Board of Directors of the General Association of the Mid-Continent Oil and Gas Association, 309 Tulsa Building.

2:00 p.m.—Afternoon session of the A.S.M.E., Hotel Tulsa.

"Fluid-Meter Research of Flow of Oil Through Orifice Flow Nozzles and Venturi Throats," W. H. Carson, University of Oklahoma, Norman, Okla.

"Equivalent Lengths and Diameters," W. G. Heltzel, Stanolind Pipe Line Co., Tulsa.

6:30 p.m.—General Association of the Mid-Continent Oil and Gas Association Annual Banquet will be held in the Crystal Ballroom of the Mayo Hotel. The toastmaster will be the President of the General Association (J. D. Collett, independent operator of Fort Worth, Tex.) and the assistant toastmasters will be the President of the Kansas-Oklahoma Division (E. R. Filley, Texas Co., Tulsa), the President of the Texas Division (E. T. Moore, President, Simms Oil Co., Dallas), and the President of the Louisiana-Arkansas Division (J. R. Crawford, independent operator, Shreveport, La.).

THURSDAY, MAY 17

Directors of the Day: J. Edgar Pew, B. E. Horrigan, J. P. Flanagan, A. W. Leonard, Frank J. Hinderliter, Rush Greenslade, W. G. Skelly, W. L. Connelly, J. H. Satterwhite.

In Honor of: Illinois, Casey, Robinson.
Michigan, Muskegon.
Independent Petroleum Association of America Day.

8:00 a.m.—Golf Tournament, second and third round matches in all flights, 18 holes.

9:00 a.m.—A.S.M.E. Inspection Trip of Oklahoma City Field and University of Oklahoma Experimental Engineering Laboratories, Norman, Okla. Leave from Hotel Tulsa.

9:30 a.m.—Sixth Mid-Continent Oil and Gas Association Safety Meeting.

10:00 a.m.—Mid-Year Meeting of the Independent Petroleum Association of America at Mayo Hotel.

MEMBERSHIP MEETING

"Production Under the Code," C. F. Roeser, vice president, Planning and Coordination Committee.

"Marketing Under the Code," B. L. Majewski, member of the Planning and Coordination Committee.

"Refining Under the Code," Paul G. Blazer, Ashland Refining Co., Ashland, Ky.

"Problems of Stripper Well Operators Under the Code," W. J. Brundred, Oil City, Pa.

12:30 p.m.—Dinner for "Old Timers" at restaurant on grounds, under Barney Horrigan, chairman.

1:30 p.m.—Sixth Mid-Continent Oil and Gas Association Safety Meeting.

2:00 p.m.—Independent Petroleum Association of America, Directors and Executive Committee Meeting, Mayo Hotel.

2:30 p.m.—Band concert by Tulsa High School band.

3:30 p.m.—Awarding of Medal to the "Grand Old Man of the Oil Industry" at the "Old Timers" Meeting, at replica of old Drake well.

4:00 p.m.—Celebration of Diamond Jubilee of the Petroleum Industry in front of replica of Drake well with Titusville, Pa., delegation officiating.

FRIDAY, MAY 18

Directors of the Day: R. E. Day, R. O. Dietler, C. P. Dimit, Henry Greis, P. M. Miskell, C. Morris, Roy B. Jones, F. B. Parriott, T. R. Weymouth, A. W. Peake.

In Honor of: Official Safety Day.
Marketer's Day.

8:00 a.m.—Golf Finals.

9:30 a.m.—Meeting of Marketers, Jobbers and Dealers with Refiners, at Hotel Tulsa.

2:00 p.m.—First Aid Contest under direction of Petroleum Safety Council and American Petroleum Institute.

2:30 p.m.—Open Forum under auspices of Scientific and Technical Committee of the International Petroleum Exposition at Mayo Hotel, W. A. Schlueter, chairman.

SATURDAY, MAY 19

Directors of the Day: P. D. Hayes, W. A. Schlueter, Clarel B. Mapes, Alf G. Heggem, E. J. Nicklos, J. M. Hayner, Harry H. Rogers, William D. Moorer, Hugh Stalcup.

In Honor of: Colorado, Denver.
Arkansas, El Dorado.
Refiner's Day.

9:30 a.m.—Meeting of Marketers, Jobbers and Dealers with Refiners at Hotel Tulsa.

9:30 a.m.—The American Association of Petroleum Geologists, Research Committee, Donald C. Barton, chairman, will hold a special meeting on the fourth floor of the Chamber of Commerce Building.
The Research Committee of the American Petroleum Institute.
The Tulsa Geological Society.
The Stratigraphic Society of Tulsa.
The Oklahoma City Geological Society.
Subject: "Geological Changes in Petroleum Reservoirs Affecting Recovery."

12:15 p.m.—Tulsa Engineer's Club Meeting, Chamber of Commerce Dining Room.

Bailing, Shooting, Tubing and Acidizing Have All Been Tried in Deep Test at Binger, Oklahoma

By L. G. E. BIGNELL
Petroleum Engineering Editor

The Denver Producing & Refining Co.'s No. 1 A-Dah-Noe, C NW SW SW Section 34, Township 10n, Range 10 WIM, in Caddo County, Oklahoma, 6 miles east of the town of Binger, was finished with 9,910 feet of 6⅝-inch 26.2-pound National Tube Co. casing on March 11 and cemented the same day with 3,000 sacks of cement using the Halliburton Oil Well Cementing Co.'s multiple stage method. After the cement had set for seven days, or on March 18, the top float collar and plug was drilled out. Three days later the drill was run to the bottom of the hole and part of the cement in the open hole below the bottom of the casing drilled out.

This work did not put the well on production in the ordinary sense of the expression because the well did not flow through the 6⅝-inch casing by natural pressure. Many reasons have been assigned for this failure to flow and the owners of the well have tried nearly everything suggested in endeavoring to get this producer to flow through the casing or through a string of 2½-inch tubing.

Completion Operations

The engineers for the Baroid Sales Co. were called upon to supervise the mixing of the mud fluid used in drilling in and about 95,000 pounds of Baroid or mud weighting compounds was added to the Ada mud while this hole was drilled below 9,900 feet. It is reported that the top of the producing horizon was reached at about 9,910 feet and the original depth of the hole was 9,982 feet, or it was drilled in 72 feet. During this operation a large amount of weighting material was necessary to keep the well under control and prevent the gas from so badly cutting the mud that the weight of the fluid column would be reduced below formation pressure and the well get out of control.

This seems very definite evidence that this formation as first penetrated did give up high pressure gas and oil. This condition of gas cutting the mud fluid continued up to the time that the cementing job was completed. When the cement was forced into the bottom of the hole below the casing and up behind the casing it was noted that the flow of gas ceased. The deficiency of gas is the one noticeable feature of this well ever since.

It is known that a bridge formed at 8,240 feet composed of heavy mud mixed with a large quantity of Baroid pumped into the well before the lower plugs were drilled out. This bridge was removed by the use of the Cavins suction bailer described in the October 28, 1933, issue of The Oil and Gas Journal. A 4¾-inch diameter Cavins bailer was trucked to the well from Oklahoma City on March 27 to remove this upper bridge, and later removed another similar bridge that had formed at 9,300 feet.

These two cleanout operations opened the hole inside of the casing and later a 3½-inch diameter Cavins bailer was run on a five-eighths inch sand line to the bottom of the hole and removed shale, mud and cement from the hole drilled into the formation below the casing. After this clean-out to the bottom of the well the fluid made up of oil and mud flowed into the casing and filled it to within 1,700 feet of the top. The lack of gas prevented the well from flowing. If this fluid was all water it would exert a pressure of about 3,600 pounds per square inch against the formation. If all of 44.7 degrees A.P.I. gravity oil, the gravity of the crude oil secured from this well, the pressure of the column against the formation would be about 2,890 pounds per square inch.

It is understood that the fluid has actually filled the casing to within 900 feet of the top. The well has made several flows after it has been shut in at the casinghead for from 24 to 72 hours. There has been a tendency for these flows to continue for a longer period and deliver more oil into the tanks as the well has been worked on. One flow on April 25 lasted for about 67 minutes and produced approximately 300 bbls. of oil, after the well had been shut in for about 48 hours.

Shooting the Hole

After cleaning the well with the Cavins bailer to the bottom of the drilled hole without the desired results it was decided to try shooting the formation. This was done April 15 after the well had been bailed and swabbed without securing the desired results.

The first shot was a 10-quart size using a Risonite 3-inch shell set at 9,974 to 9,980 feet 9 inches. The total depth of the hole is reported as 9,986 feet with 70 feet of open hole which places the bottom of the casing at 9,916 feet. At the time of the shot there was approximately 8,000 feet of fluid in the hole.

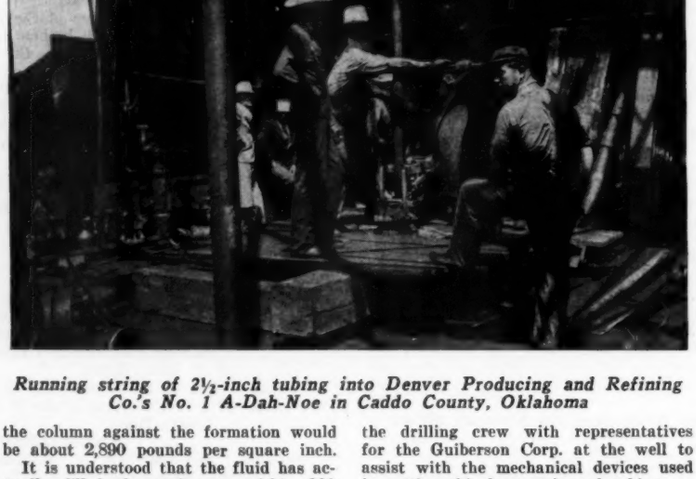
After the shot the Cavins bailer was used to clean out the hole and removed shale, cement and other debris, but the well did not flow naturally.

A second shot of 20 quarts of liquid nitroglycerin was set off in the hole on April 20 with the 3-inch Risonite shell landed at 9,972 to 9,986 feet. Both shots were placed by shooters for the American Glycerine Co. of Tulsa.

After the second shot the Cavins suction bailer was again used and cement, shale and other material removed from the hole, but still the well did not flow naturally. It filled up quickly to near the top of the casing but lacked gas and formation pressure sufficient to cause it to flow into the tanks, except after a period of being shut in at the casinghead to permit gas to accumulate and lighten the weight of the fluid column.

Running Tubing

After these attempts to cause the well to flow through the 6⅝-inch casing had failed it was decided to run a string of 2½-inch tubing. This work was done by the drilling crew with representatives for the Guiberson Corp. at the well to assist with the mechanical devices used in setting this long string of tubing.



Running string of 2½-inch tubing into Denver Producing and Refining Co.'s No. 1 A-Dah-Noe in Caddo County, Oklahoma

The work started at 2 p.m. Saturday, April 28, and continued until 6 p.m., when they shut down for the night. Work was resumed at 8 a.m. April 29 and the string landed at 5 p.m. that day.

This is a string of 2½-inch 10-thread upset J. & L. tubing and set at 9,088 feet because it hung in hole at that depth. Guiberson heavy duty tubing spider was used at the well head to handle the tubing into the hole and one Duplex 6⅝"x2½" upset Guiberson tubing catcher was placed at 1,201 off bottom and a Type "E" Guiberson tubing catcher of the same size as the lower one was placed at 3,291 feet off bottom or within 5,681 feet from the top of the casing.

The tubing is hung in a special Hinderliter tubing head that fits over the 6⅝-inch casinghead and has slips 9 inches long. No packers were used on the tubing and the end is open. If the bottom of the hole is 9,986 feet from the surface there is 898 feet of hole below the bottom of the tubing.

Before this string of tubing was run the well had been shut in for some time and when opened made a flow of 205 bbls. of oil into the tanks in 20 minutes. There was very little gas but the tubing crews noted that such gas as did arise from the casing had a sweet odor and the effect was to nauseate those inhaling it and to make them rather dizzy. This does not have any particular significance except that the noted effect was probably due to the inhaling of very rich gasoline vapors high in methane and ethane fractions that were given off by this high gravity crude oil.

The tubing was run using the drawworks with 1⅛-inch lines strung in the derrick with National Supply Co.'s Ideal tubing elevator of the slip type. As stated, the string of tubing was run to 9,088 feet without difficulty even though the outside diameter of the Guiberson tubing catchers is about 6 inches, while the inside of the casing is only 6¼ inches, giving a clearance of but one-eighth inch.

Acidizing

When the tubing was in place it was decided to load the hole with hydrochloric acid to remove any dissolvable material. Samples of the cement and other material removed from the hole by the Cavins bailer was sent to Dowell, Inc., laboratory at Midland, Mich., for examination.

The samples of the formation recovered by the Cavins bailer after the shots showed a good deal of cement in the sand. This cement and mud forced into the formation is one cause of the well's inability to flow naturally and it was hoped that by introducing hydrochloric acid into the formation this material would be dissolved and removed.

It was decided to treat the well with 2,000 gallons of Dowell XX solvent and the work was started at 6:10 p.m., April 30, and the first 1,000 gallons entered the tubing at 6:35 p.m. and the second 1,000 gallons was pumped in at 7 p.m., April 30.

The next operation was to bleed back about 50 bbls. of oil from the annular space between tubing and casing to provide space for the handling of the acid. Withdrawing the oil through the casinghead connections permitted the acid to flow out of the tubing and into the bottom of the hole.

To force the acid out of the tubing and casing and against the formation crude oil was pumped into the tubing at intervals and the following table gives the various operations in their chronological order:

Date—	Time	Casing pressure (lbs.)	Tubing pressure (lbs.)	Oil added (bbls.)	Accumulative oil (bbls.)	Remarks
April 30	7:00 p.m.	500	0	8	8	Slight vacuum.
April 30	8:10 p.m.			27	35	Slight pressure.
April 30	8:30 p.m.	700	0	13	48	In tubing.
April 30	8:40 p.m.	1,000	500			Read pressure.
April 30	9:00 p.m.	1,100	800			Pressure reading.
April 30	9:10 p.m.	1,400	1,200	17	65	Added oil—pumping.
April 30	9:25 p.m.					Shut down pump.
April 30	10:35 p.m.	1,350	800	5	70	Started pump.
April 30	10:50 p.m.	1,700	1,200			Shut down pump.
May 1	12:10 a.m.	2,350	2,000			Started pump.
May 1	12:35 a.m.			5	75	Coupling leak.
May 1	5:15 a.m.	1,400	845			Checked pressure.
May 1	5:15 a.m.	2,250	1,800	5	80	Started pump.
May 1	5.45 a.m.					Shut down pump.
May 1	8:10 a.m.	1,600	1,125	2½	82½	Pump started.
May 1	8:15 a.m.	2,000	1,600			Pump down.
May 1	9:20 a.m.	1,800	1,200	1½	84	Pump going.
May 1	9:30 a.m.	2,000	1,700			Shut down.
May 1	11:10 a.m.	1,800	1,300	2½	86½	Pump going.
May 1	11:15 a.m.	2,100	1,700			Shut well in.

(Continued on Page 61)

Large Majority of Industry Favors Ickes' Bill But Active Opposition Makes Passage Doubtful

By HUGH D. MALLON
Washington Bureau, The Oil and Gas Journal

WASHINGTON, D. C., May 7.—The Federal Oil Control bill sponsored by Secretary of the Interior Harold L. Ickes, the Oil Administrator, is receiving the condemnation of objectors who would dislike to see the petroleum industry once more in a prosperous condition through any control of crude production. This present proposed legislation is being given the support of about 95 per cent of the industry.

At the present time because of the clamor of opponents, Senators and Congressmen are being misled as to the necessity for this legislation, and unless the industry supports this measure in more than a passive way, the chances of it even coming to a vote are very remote. The objectors to the bill are deluging the Chairman of the Senate Interstate Committee with telegrams and letters, and unless some action is taken and taken quickly by the legitimate operators to overcome this propaganda production stabilization will not become an established fact during this session of Congress.

Ickes Hits Opponents

That Secretary Ickes is well aware of the kind of opposition that has developed to this measure is indicated by the statement which he issued on Friday of last week, in which he said:

"Only a small minority of oil operators in East Texas are responsible for the campaign of publicity designed to halt passage of the pending oil bill. Other Texas operators have assured me that the oil industry and Texas business interests are strongly opposed to Texas being allowed an additional 200,000 bbls. of oil production a day.

"The agitation against the bill comes solely from those who would make money themselves if a greater production is permitted the East Texas Field, and they are using every effort to bring this about, utterly oblivious of the fact that the rest of the huge oil industry of the country would be thrown completely out of balance, and the chaotic conditions of a year ago would be brought back immediately.

"Evidently it has become necessary to point out that the publicity campaign against the oil bill is backed and financed by the 'hot oil' crowd of Texas. They are, regardless of the consequences to others and to the entire oil industry, fighting against legislation which would put an end to their thieving of their neighbors' oil from the common pool tapped by their wells.

"Our program of balancing production with consumption has brought oil prices to a living level and resulted in the reemployment of thousands of workers. All of this would be sacrificed to the selfish greed of this small group of Texas operators if they were allowed to have their way."

Statement by P. & C. Committee

The Planning and Co-ordination Committee has also issued a statement to the effect that federal regulation of crude production is necessary. It calls attention to the fact that although several of the states have enacted laws and established commissions to limit and control production, the difficulty which has been encountered by these statutes and commissions is that the different states do not agree on their respective shares of the market, some contending for more than others are willing to concede, and the different commissions are urged on by the operators in their states. This applies to lawful production, but in addition to this conflict between the states the problem of "hot oil" is also to be considered. In both connections, the committee says, state control and enforcement have proven insufficient from a national standpoint and the industry must look to Congress for relief or else suffer until nature works a cure. There is a choice between central control and chaos.

FRANK R. COATES
Chairman Refinery Subcommittee of P. and C. Committee

Hot Oil Producers Active

The statement continues with the following: "A certain minority element in the industry which heretofore has opposed the code and all efforts to curb "hot oil" production is now besieging Washington with telegrams and importuning Congressmen to oppose the bill. Of course there may be others who do not favor the measure. We hope the stable elements in the industry will rally to the support of the principle."

In connection with the oil bill Amos L. Beaty, Chairman of the Planning and Co-ordination Committee, issued the following statement concerning his recent speech before the United States Chamber of Commerce: "My attention has been called to reports that in the paper which I read before the United States Chamber of Commerce last Wednesday I opposed the oil control bill introduced by Senator Thomas. Nothing of the kind is true. My paper was devoted to the principle of the bill. Congress has the power to regulate commerce, and my effort was to show that the proper remedy in the present oil situation is through the establishment under Federal authority of quotas in commerce for oil, rather than production control, and this is the very principle of the bill. It is the sale and shipment of oil that is controlled, not production. True the bill provides for production quotas, but only after enforcement of quotas to move in commerce has failed. I am strongly in favor of the principle of the bill."

A vigorous attempt is being started to relieve the pressure which has been put upon the refining branch of the industry by the present price of crude and the extremely low market for refined products, notably motor fuel. The refining subcommittee of the P. and C. Committee is being re-organized. Howard Bennette, former chairman of the sub-committee has resigned that post and has been appointed National Co-ordinator by the P. and C. Committee, with the approval of the Administrator. Mr. Bennette is proceeding with the organization of the new office in which he has been placed and expects to be ready for action within a very few days. The post of National Co-ordinator was created by the recently approved refinery amendment to the Code. It is felt that this position will involve a great deal of work and therefore, Mr. Bennette believed that it would be impossible for him to continue as chairman of the subcommittee.

Frank R. Coates, newly appointed member of the Planning and Co-ordination Committee, was immediately chosen by the Committee to fill the vacancy in the chairmanship of the refinery sub-committee caused by the resignation of Mr. Bennette, and R. R. Irwin, president of the White Eagle Petroleum Corp., was appointed as vice-chairman of the subcommittee. There had previously been no occupant in Mr. Irwin's new position.

Transportation Group to Meet

The Transportation Sub-committee was given four new members, A. E. Watts, member of the P. and C. Committee and Charles F. Roeser, also a member of the Committee, H. T Klein of The Texas Co. and A. W. Peake of the Standard Oil Co. of Indiana. The Transportation Sub-committee has a meeting scheduled in Chicago which will probably be held on May 10. At that time consideration will be given to the preparation of a report on pipe lines which it has been learned was requested by the Administrator.

Provision is made in the refinery amendment to establish suitable arrangements for the purchase of gasoline from non-integrated and/or semi-integrated refiners and the resale of that product through orderly marketing. The committee has been considering plans to put this provision into effect, one of which plans would authorize the National Co-ordinator to appoint an agency, or agent, to perform the duties of seeing that the market is maintained in an orderly fashion. His duties would be to keep a check on the market and if he found a refiner in a locality who had no market for his motor fuel, arrangements should be made for the purchase of the surplus by some other company which did have a market. He would perform the duties of a broker, as at no time, would this agency or agent have title to the product, or even custody thereof. He would merely find a market for a product which might break down the market structure if allowed to stay on the local market.

Van Covern Considered

The Board of Review, the appeal board set up in the new sections of the Code, has not yet been selected, but one man seems almost certain to be appointed. Fred Van Covern, of the Statistical Subcommittee of the P. and C. Committee, is eminently suited to fill such a position, and is being very seriously considered for appointment. The committee has found that there are few men qualified to fill these positions who do not have affiliations with some company. It is their desire to appoint members who will compose an impartial board, and when the board is finally set up the members will be handpicked from the best talent available.

Wage differentials, which are being formulated by the Petroleum Labor Pol-

(Continued on Page 61)

Administrator's Report on Crude Stocks

Stocks of domestic and foreign crude petroleum at the close of the week ending April 28 totaled 340,718,000 bbls., a decrease of 628,000 bbls. from the total of 341,346,000 bbls. on hand at the end of the preceding week, Harold L. Ickes, Secretary of the Interior and administrator of the code of fair competition for the petroleum industry, announced today. This decrease which follows a comparable decline during the previous week, comprised decreases of 421,000 bbls. in domestic crude stocks and 207,000 bbls. in foreign crude stocks.

Current reports of the industry indicate that crude oil production for the week ended April 28 was approximately the same as for the week ended April 14. Crude oil production for the week was approximately the same as for the week ended April 21 but runs to stills declined. The approximate daily average balance for crude oil during the week ended April 28 was as follows (barrels): Production, 2,475,000; imports, 81,000; decrease in stocks 90,000; equals runs to stills, 2,430,000; exports, fuel, losses, etc., 216,000.

CRUDE PETROLEUM STOCKS REPORTED BY COMPANIES HOLDING 100,000 BBLS. OR MORE

Grade of crude oil—	Stocks held by reporting companies: April 21, 1934 (barrels)	April 28, 1934 (barrels)	Change from April 21, 1934 (barrels)
Pennsylvania Grade	4,758,000	4,837,000	+ 79,000
Other Appalachian, including Kentucky	1,293,000	1,322,000	+ 29,000
Lima-Northeast Indiana-Michigan	1,613,000	1,603,000	— 10,000
Illinois-Southwest Indiana	11,201,000	11,118,000	— 83,000
North Louisiana and Arkansas	11,134,000	11,106,000	— 28,000
West Texas and Southeast New Mexico	29,787,000	29,520,000	—267,000
East Texas	43,761,000	43,601,000	—160,000
Other Mid-Continent	157,701,000	157,791,000	+ 90,000
Gulf Coast	14,873,000	15,091,000	+218,000
Rocky Mountain	27,437,000	27,489,000	+ 52,000
California	34,327,000	33,986,000	—341,000
Total domestic crude	337,885,000	337,464,000	—421,000
Foreign crude	3,461,000	3,254,000	—207,000
Total crude	341,346,000	340,718,000	—628,000

XUM

Derrick on Specially Built Barge Is the Solution of Drilling on Louisiana Water Locations

By NEIL WILLIAMS
Gulf Coast Bureau, The Oil and Gas Journal

HOUSTON, Tex., May 5.—When the Jefferson Island Oil Co. started out to develop the sulphur deposits in the cap rock of that portion of Jefferson Island salt dome underlying Lake Peigneur, a body of water some 10 to 15 feet deep, in Iberia Parish, Louisiana, it was faced with the problem of drilling a large number of shallow wells under conditions which involved a possible excessive expenditure of time and money.

The location for the wells was in the middle of the lake about a mile from shore. In drilling practices known at that time for such water locations it was necessary to set up the rigs on piling or matting foundations. Under any circumstances such operations are costly and slow, and in the case of the Lake Peigneur project, none of the wells being over 900 feet deep, they were particularly undesirable in view of the concentrated development and the need that the completion of wells be kept up at fairly rapid rate to build up and maintain the volume of production.

In the first operations of the Jefferson Island Oil Co. piling foundations were used for the rigs and others equipment. Bridges were built to the various locations for the moving of equipment and supplies. Construction of bridges proved extremely costly and it was not long before these were abandoned and barges were provided for the transportation of equipment.

Barges, however, did not eliminate the excessive cost of setting up wells on piling foundations, and the time involved in driving, bracing and capping piling made the work of rigging up, drilling and completing of a well too slow. Under the circumstances it took considerably more time, and cost much more to rig up and tear down a well than the actual drilling time of a well. Ten days to two weeks ordinarily were required to drive the piling and complete the piling job for a well, and as only one rig was used and that requiring less than a week to drill a well it was not possible to keep up with the rig.

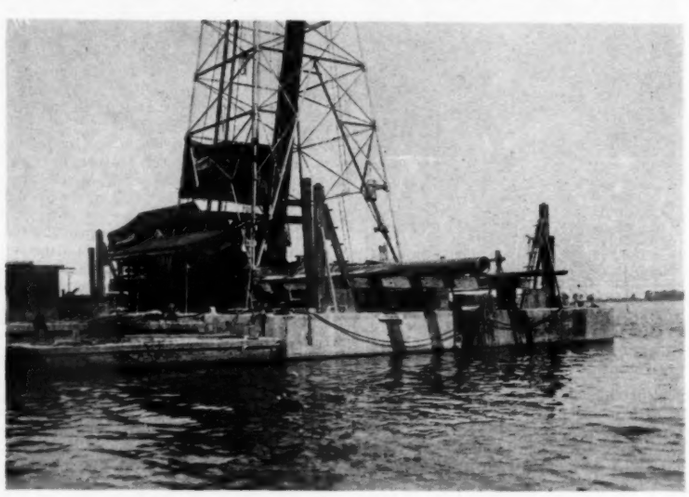
The problem of keeping up drilling at a sufficient pace and at the same time reducing development costs to a figure consistent with profitable returns and in line with average shallow drilling operations caused the company to give a great deal of consideration to drilling methods.

Derrick on Barge

Out of this situation, the idea was conceived by E. LaGuerre, then superintendent and chief engineer of the company, of setting up the derrick and drilling machinery permanently on a specially built barge, which could be towed around from one location to another and which would eliminate the building of foundations of any kind.

Although the plan generally was not looked upon as feasible, the barge was built and has been used exclusively since then. It is constructed of all welded steel and is about 60 feet long, 40 feet wide and 5½ feet high, drawing less than 6 inches. A 4-foot opening or slot, called a "bay" is provided down the middle of the barge, which permits the removal of the barge from around the pipe and connections of a completed well.

Mounted on the barge is a 64-foot steel, tubular derrick, electrically driven drawworks, pumps, electric motors for the drawworks and pumps, the mud pit and pipe racks. The center of the derrick and rotary is directly over the "bay" in the center of the barge, which is ready to drill at any time, carrying all pipe and other equipment along with it. It is only necessary to tow the barge to location and anchor it which is done by four spudders, 8-inch pipes, one in each corner, which, passing through the barge, are driven into the bed of the lake. Power for the electric rig is supplied by a submarine cable which the barge carries and which can be connected quickly to the nearest power line. Permanent power lines have been strung on poles across the lake and around the location of the operations.



First floating drilling barge of Jefferson Island Oil Co.

To permit the barge to rise and fall with the water level of the lake during drilling operations and while the barge is connected to the casing of a well, telescopic joints have been devised for the connections. The level of the barge is maintained by a very accurate distribution of drilling machinery. The buoyancy of the barge which enables it to draw very little water under load, together with the weight and balance, makes the barge a very steady foundation.

Skidding Barge Rig

After completion of a well, it is only necessary to disconnect the barge from the well head connections, pull the four spudders and tow the barge to a new location. The barge slips away from around the well through the slot or "bay." The outfit has been moved from one well and started drilling on another in as short a time as 10 minutes, and by it wells now are drilled to depths ranging from 600 to 900 feet and equipped to produce sulphur in less than a week. The average rate of completion runs about three and one-half wells a month.

Since the barge has been put in operation a total of close to 90 wells have been drilled. The barge cost only $8,500 and it is estimated that as much as $5,000 a well has been saved by its use, including cost of the piling foundations and the cost of time involved in rigging up and tearing down each time a well is drilled. Not only has a tremendous financial saving been effected but also the barge has enabled the speeding up of development of the field in number of wells which can be drilled within a month and has provided an efficient and convenient method of operation.

As a result of the success of this barge, other barge drilling outfits have been put into operation by various other companies in southern Louisiana where water located fields and wildcat areas are numerous. Among these companies have been the Texas Co., Freeport Sulphur Co. and Humble Oil & Refining Co. With the advantages of this method of drilling water locations becoming recognized, the adoption of the drilling barge is being applied to various types and specific uses. It is possible the barge may become the solution to the economical problem of drilling water locations.

Although this drilling at Jefferson Island is for sulphur, operations, until the final completion of the wells, are the same as if for oil. In starting a well, approximately 40 feet of 12-inch pipe is run as the first string of pipe to shut off the lake water and silt. A 10-inch hole then is carried to the top of the cap rock which is found around 600 feet where a string of 8-inch casing is set and cemented. The hole then is cored and drilled to the bottom of the sulphur zone where 6-inch pipe is cemented.

For the production of sulphur, there are two sets of perforations at the bottom of the 6-inch pipe. The lower set serves as strainer for the sulphur as it enters the 6-inch pipe, and the upper for the injection of hot water into the sulphur zone for dissolving the sulphur, a solid in its natural state in the cap rock. Inside the 6-inch pipe is run a 3-inch pipe with bottom sealed to the 6-inch pipe at a point between the two sets of perforations, this being the flow string. Inside the 3-inch flow string then is hung a 1-inch air line.

Producing Sulphur

The operation of producing sulphur consists of forcing water superheated to a temperature of between 315 and 320 degrees down the well through the 6 and 3-inch pipes. This water penetrates out into the sulphur through the perforations in the bottom of the 6-inch pipe. Sulphur begins to melt at a temperature of around 240 degrees, and as it is about twice as heavy as water, the molten sulphur runs to the bottom of the well. When a sufficient quantity is accumulated and is forced up into the 3-inch flow string some distance by the pressure of the water pumps and head of water between the 3 and 6-inch pipes, part of the water pressure is cut off and the sulphur is lifted to the surface by compressed air injected through the 1-inch line. It is discharged into steam heated sumps or vats, from where it is pumped through an insulated line, inside of which is a small steam line to keep the sulphur in a molten state, to large vats. The sulphur, flowed into these vats in thin sheets, solidifies rapidly, forming, when the vat is filled, a large block of solid sulphur. The vats are constructed of rough boards which can be torn down permitting the sulphur to be blasted to pieces and loaded by locomotive cranes into box cars for shipment.

Sometimes sufficient sulphur will be melted at a time to permit a well to produce for several weeks. When the accumulation of molten sulphur lowers in the bottom of a well so that hot water enters the 3-inch flow string through the lower set of perforations in the 6-inch pipe, the water comes to the surface and flashes into steam and the well is said to "blow." Air then is cut off and hot water again is pumped down the 3 and 6-inch pipes until sufficient melted sulphur again is collected in the bottom of the hole to produce. The latter operation usually requires about three hours.

Lines on Trestles

As the wells are about a mile from shore, it was necessary for the Jefferson Island Oil Co. to build a trestle of creosoted piling and timbers to the power plant on the shore for support of the required hot water, steam, cold water, air and molten sulphur lines. The hot water, steam and molten sulphur lines are insulated with 3-inch mineral wool covered with galvanized iron. Large expansion joints on these provide for the expansion and contraction. The lines terminate at the sulphur station adjoining the wells where are located the booster pumps for forcing the hot water down the wells, and the steam jacketed sumps into which are discharged the molten sulphur from the wells and from which the liquid sulphur is pumped by steam jacketed centrifugal pumps to the storage vats on the shore.

Water Treatment

To provide a water reserve for continuous operation of the power plant, a 20-acre reservoir with capacity of 50,000,000 gallons has been constructed. As all water must be entirely free of all scale and foreign substance, the water from the reservoir is pumped directly into a treating plant by two 600 g.p.m. pumps. The treating plant consists of two 40,000 g.p.h. Cochrane units, which are of the hot-process type, using lime and soda ash. From these units the water passes through six filters filled with nonsilicate filter material. In this process the water is heated to a temperature of approximately 200 degrees by the use of exhaust steam from the turbine driven pumps and a continuous blow-down of about 5 per

(Continued on Page 61)

Present Pipe Line Construction Features Use of Reconditioned Pipe and Protective Coatings

By L. G. E. BIGNELL
Petroleum Engineering Editor

The modern pipe line crews do not bear much resemblance to the gangs of former years either in personnel or type of men making up the outfits. The size of the gang is smaller due largely to the use of special equipment that has been developed to assist in this work. Because machinery is now used extensively in all pipe line construction operations the men employed are of the skilled mechanic class rather than the old type of pick and shovel men. The rate of movement of operations along the right of way has also made a material difference in the living conditions of the men and they are no longer housed in temporary camps or bunk houses constructed at points that were convenient to the work for several weeks at a time.

When the older lines were laid mules and horses played an important part in all transportation problems. Now the motor truck and tractor handles all equipment to the right of way. With automobiles the men are able to get to and from their work and live in nearby towns or cities where they have modern accommodations. These conditions have completely eliminated the former camps and corrals and their accompanying attendants and hangers-on.

Use of Machinery

These changes mark the advent of machinery into this industry and the selection of the men to operate the machines has drawn into the crews men who are skilled in the various details pertaining to the operations involved in preparing and laying the pipe. An appreciable number of these men are college graduates or men who have specialized in some particular science and are recognized as qualified to direct details of this now rather exacting work.

The welded pipe line has eliminated the old "tong" gangs entirely. One visiting the right of way of the modern pipe line under construction will miss the tap-tap of the gang leader's hammer on the pipe and the grunts of the men as they lay to on the tongs. The picturesqueness has been eliminated from the scene but in its place has been substituted a higher efficiency that follows when the personal equation is largely eliminated from any mechanical operation.

When the screw couplings were used to connect the joints of pipe tightness of joint depended upon the skill of the crew and the judgment of the gang leader in deciding when the threads were "home." "Bucking-up" the pipe is the old term and after a crew of men had worked on the heavy tongs all day long in the hot sun it is not surprising they might lag a bit at the end of the day and the joints might not be made up quite as tight as they should be. These poorly made up joints later developed leaks and the loss of oil became an important item of expense in operating the pipe line system both from direct loss and loss incidental to the corrosion sometimes set up along the line because of the sulphur contents of the crude.

To remove as much of the personal responsibility from the construction work as possible the lines are now being welded either with acetylene torch or electric arc welding method. The pipe is being carefully cleaned and covered with protective coatings before it is laid in a ditch that is free of rock in direct contact with the pipe. Many refinements unthought of in former years are now practiced in the laying of pipe lines and these new methods are the result of many years of experimenting and are based upon sound economic conditions, and it is believed the results will justify the additional care because it is doubtful if it costs any more to lay the present welded lines than to put down the old screw lines of former days.

Double head powered pipe cleaning machine working on new 12-inch pipe followed by primer coating gang

Preparing the Pipe

In making a detailed study of their pipe line systems many companies have found the lines had been laid to meet increasing demands and business volume rather than to conform with good transportation practice and engineering. In other words, the system had simply "grown" and while it had served its day to good purpose in the changing economical and commercial conditions now confronting every industry many changes can be made that will increase efficiency of operation quite materially.

Cleaning new 12-inch pipe by modern methods on Stanolind Pipe Line Co.'s system in Kansas

This fact is one of the outstanding features of the present day pipe line management. Younger men, technically trained and with a great deal of past experience in the practical operation of pipe lines, have been promoted to executive positions in the major pipe line companies and they have taken the problems under advisement with the result they have made reports to the directors of their companies that clearly demonstrate changes can be made that will pay for themselves and at the same time increase efficiency in operation over a long period.

Pipe lines have several so-called "loops" in the system. These loops are lines laid in comparatively short sections to accommodate increased volumes of crude oil needed at the terminals. Some of these lines are constructed of 4, 6 and 8-inch pipe and have been in the ground for from 10 to 20 years. Examination of this pipe has shown it can be reclaimed for use in other systems where this particular size of pipe will best suit conditions.

These smaller lines are taken up and the pipe cleaned and reconditioned. The threaded ends of the pipe are cut off and the ends beveled for welded connections. The line as relaid is a welded job and the pipe is coated with protective materials that will insure a long life. It has been found pipe line failures are not due to pressures exerted inside of the pipe but rather to the actual failure of the pipe due to corrosion by pitting through the pipe walls. If the exterior of the pipe contains some pits or scars due to corrosion it is still suitable for reconditioning and further use if this work is properly performed.

The old ditches are opened by hand labor and the couplings split with a torch and the pipe picked up by winch mounted upon a tractor fitted with boom, and then loaded upon trucks. It is transported to centrally located cleaning yards where the soil and rust is removed by passing the pipe through stationary cleaning machines and then carefully inspecting it.

Construction Work

After this work has been done by the pipe line company the pipe is turned over to the pipe line construction company. They cut off the end of the pipe and at the same time bevel it and prepare the pipe for welding into the continuous tube that forms the pipe line system.

Some contractors prefer to weld the pipe into double lengths at the pipe yard and then haul it to the right of way to be assembled by the firing line crew of welders who weld the numerous joints of pipe into sections several hundred feet long.

For this purpose the pipe is supported upon wooden or welded pipe horses alongside the ditch and several welders tack the lengths of pipe together so it lines up and ends match. They then weld part way around the joint and the pipe is turned by an operator on a tractor with winch and boom. This permits the completion of this welding operation and joins the pipe into sections.

These long length of pipe are next moved over the ditch and the lengths of pipe are joined together by the "bell hole welding crews." These "bell holes" are

(Continued on Page 197)

Contracts Must Enable Refiner to Use Natural Gasoline Economically Throughout the Year

By L. P. CALKIN
Phillips Petroleum Co.*

Natural gasoline manufacturers have been confronted with a heavy decrease in the demand for natural gasoline on the part of refiners, who until fairly recently have been considered the one and only market for natural gasoline. Figures showing the motor fuel produced in January, 1930, and January, 1934, reveal that the production for these two months differs by less than 100,000 bbls., while the amount of natural gasoline used decreased approximately 600,000 bbls. The territory covered by these figures is that of the Mid-Continent area and states south of that area. All of us are familiar with the changes that have taken place in the art of petroleum refining during the last few years and all of us realize that these changes have been responsible in a large measure for the decreased refinery demand for our commodity.

For the present day refiner to obtain all of the volatility he needs in his finished motor fuel without purchasing natural gasoline he must make a considerable investment in reforming units, vapor recovery plants, etc. Practically all of the larger refiners today have already made these investments. However, there remain a large number of smaller plants that have not done so and there are possibly some of the larger ones that have not gone as far in this direction as is possible. In order to stop the trend away from the refinery use of natural gasoline it would appear that some concerted action must be made by the natural gasoline manufacturers to write contracts with refiners on some basis that will enable the refiner to use natural gasoline economically throughout the year. In other words, contracts must be of such a nature that it will be cheaper for the refiner to obtain volatility by means of natural gasoline rather than by means of reforming units.

Tank Wagon Prices as Basis

In the earlier days of the industry some contracts were written based on the tank wagon prices that obtained in the territory in which the purchasing refiner sold his product. Sometimes contracts of this sort paid the manufacturer large premiums over the market while at other times the return on the contract was considerably under the market price.

Other of the earlier contracts were based on the market quotations for the old "AA" grade natural gasoline with maximum prices at some differential over the 58-60 Navy gasoline price and with minimum prices at differentials under the 58-60 Navy gasoline prices. In some cases, contracts even had flat minimum prices. Fortunately or unfortunately, contracts of the foregoing type are now more or less obsolete.

It is not the purpose of this paper to outline types of contracts which the Phillips Petroleum Co. favors but to discuss the various types of contracts which may accomplish the end which we all have in mind, namely, the continued use of natural gasoline by refiners.

The simplest contract is, of course, based on quotations for Grade 26-70 natural gasoline, date of shipment. Such a contract protects neither the refiner nor the manufacturer. At certain seasons of the year the buyer is in a position to buy large quantities of natural gasoline and show a profit on the transaction. At other times the refiner is compelled to absorb a loss on every gallon of natural gasoline he purchases. At such times the refiner is apt to forget the profit he made on his natural gasoline purchases earlier in the year and remember only the loss incurred during the period of high prices.

Tries to Cut Down Loss

As the price of natural gasoline advances beyond a certain point the refiner tries to cut down his loss by using less and less natural gasoline and at the same time he begins to figure out ways and means of operating his refinery so as to use as little of our product he can. Once a refiner has reduced his natural gasoline requirements or even quits using it entirely as a result of high prices, he does not purchase the same quantities again until prices sink to abnormally low levels. When this happens short periods of high prices frequently result in long periods of low prices; and the harmful effect of high prices is cumulative because each time we go through such a period someone figures out how to get along permanently with less natural than he had been previously using.

The refiner can be protected against a runaway natural market by giving him a contract based on the market price for Grade 26-70 with a maximum price based on U. S. Motor gasoline. During the greater part of the year natural gasoline shipped under such a contract goes at the market price and everyone is more or less satisfied unless, as has happened for several years past, the market price is below the manufacturing cost. During the late summer and fall of the year, natural gasoline prices ordinarily advance to such a point that the protection feature of the contract is effective.

In very few cases are contracts of this sort written in which the protection or stop based on U. S. Motor gasoline prices is sufficiently low to enable the refiner to continue the use of natural without a direct monetary loss. As a rule, however, the refiner is human, and if the quoted price of natural gasoline does not stay too close to U. S. Motor over too long a period of time he figures he has made a good purchase when he compares his protected price with the going market price. In a good many cases, however, his profit and loss statement, as far as natural gasoline is concerned, does not bear out his conclusions that he has made a good purchase. Consequently, this type of contract goes only part of the way in keeping the refiner on the books as a satisfied customer.

Based on Differential

During the last few years a number of contracts have been written in which the market price for Grade 26-70 has been disregarded entirely and a price based on a differential under U. S. Motor Gasoline used instead. On contracts of this sort, the differential under U. S. Motor is ordinarily large enough to enable the refiner to use 26-70 throughout the year on at least a "break-even" basis. If the differential under the market is large enough, it accomplishes one of the purposes which we have in mind, that is the continued use of natural gasoline by the refiner. If the refiner can improve the quality of his refinery gasoline through the use of natural and at the same time show a slight profit on the natural used, there is small possibility, other things being equal, that he will do much figuring as to just how he can eliminate the need of natural gasoline around his plant.

In connection with contracts of this sort, the quantities that the natural gasoline manufacturer can be called upon to deliver are extremely important. If, as is the case on some contracts, the maximum quantity during any one month is twice as large as the minimum quantity, the contract may not work out to the entire satisfaction of the manufacturer.

During certain periods of the year the spot market price for natural may be considerably lower than the contract price. At such times the refiner is apt to call for the minimum quantity of natural under the contract and purchase all his additional requirements on the lower spot market price from other manufacturers. During that season of the year when the spot market price for natural is higher than the contract price, the refiner may call for the maximum quantities allowed under the contract. On contracts of this sort it might be better from the manufacturer's point of view to have a relatively small difference between the maximum and minimum quantities and have definite limits set up for each month of the year.

Object to 26-70 as Base

For some time past some of the more technically minded members of the industry have contended that Grade 26-70 was not the proper grade of natural gasoline on which to base our prices. These gentlemen have contended, and perhaps rightfully so, that by so doing we have assumed that there is a market for all of the butane which we are capable of producing.

As long as the bulk of the natural gasoline used by refiners consisted of "AA" or 26-70, the "AA" or 26-70 price was the proper one to use. Modern refining methods, however, give the refiner an abundance of butane; frequently an excess, in as much as some refiners now have butane for sale. Many of the large purchasers of natural gasoline are not buying 26-70 but are purchasing lower vapor pressure material. When the industry first went to lower vapor pressures there were very few companies selling that type of natural gasoline and those companies had no difficulty in obtaining differentials over the "AA" or 26-70 price sufficiently large to offset fractionating losses.

Coincident with the rapid increase in the manufacture of stabilized natural gasoline came the change in refinery practices which resulted in an increased demand for lower vapor pressure naturals and a decreased demand for 26-70. Unfortunately, the increase in the use of the one grade did not offset the decrease in the use of the other, all of which resulted in a reduction in the differentials over 26-70 charged for the stabilized material.

Not Trying to Get Differentials

It is questionable if any manufacturer is obtaining or attempting to obtain the differentials recommended by the Natural Gasoline Association when the present grading system and specifications were adopted. The differentials charged today on contracts and on spot sales for any particular vapor pressure under 26

(Continued on Page 60)

*Presented at the annual meeting of Natural Gasoline Association of America, Tulsa, May 9-11.

Small Refinery Tanks May Be Mounted at Low Cost by Following Simple Rules

By DANIEL IRWIN

Small tanks for the refinery deserve care in mounting on foundations, for several reasons, namely space saving, accessibility, ease of inspection and maintenance, and drainage. The small tank may be classed as of 10 to 15 feet diameter and up to 15 feet high, such as is found in all parts of the plant, especially in the processing departments.

A useful design for mounting is shown in the accompanying diagram, a neat, practical base with economy of concrete and of steel. This type of foundation started from necessity resulting from a shortage of steel beams in a remote part of the world. The shape passed from the conventional rectangular form to one with slightly curved sides. The next obvious step was the full circular shape, the center pier being a feature of all the developments. Simple in plan, it was nevertheless radical to old-time refinery practice. The cost of forming is no consideration, the saving in space and the economy of materials is important. A single form may be used and re-used for many tanks of the same size base.

In rule of thumb and semitechnical design about a refinery there is no need of using handbook sizes and excessive loading or stress values, all of which mean heavy first costs. For soil loadings, there is but one way to determine them, and that is by test of the soil under the foundation in question. Often, the soil is greatly in excess of the loading value required and other times soil will be thought to be unsafe for any loading. Careful testing of bad foundation soil may often give a safe loading and save very expensive piling.

For concrete work, any ordinary 1 : 6 concrete will have a compression working value of 800 pounds per square inch but no concrete should be less than 8 inches thick. Forms must be designed to carry the hydrostatic pressure of the wet concrete. Neglect of this gives the bulging and consequently undesirable appearance of concrete walls and piers.

Design of Beams

Steel beams and the bottom tank plates must be carefully designed as beams. The tank plate is fixed and thus the only value that can be varied is the span of the plate from supporting beam to beam. The steel beams, with very heavy loading might be tested in calculating, for strength as columns at the edge of the supports. Structural grade steel will have almost uniform mill test value of 39,000 pounds per square inch elastic limit. Therefore, some working value below the elastic limit, as a working stress in tension will be safe, i.e., up to 29,000 pounds per square inch.

Bearing value of soil 1 to 4 tons per square foot.

Compression value of concrete 800 pounds per square inch.

Bearing value on concrete 500 pounds per square inch.

(Continued on Page 60)

Ease of Sending Mid-Continent Natural Gasoline to East Coast Creates Marketing Problem

By HOWARD E. FELT
Warren Petroleum Co.*

In coming before you to discuss the marketing of natural gasoline in the Appalachian district, I am embarrassed by the fact that many of my listeners doubtless are puzzled as to why a Tulsan should be selected to handle this subject. I want to explain that it was impossible for any one of the Appalachian marketers who were asked to do it to come to our meeting at this time. Since my company is marketing natural gasoline in the Appalachian district, I was told that it was my duty to present some of its problems. Therefore with acknowledgement of the help received from W. P. Dunbar and R. H. Archibald, of Pittsburgh, and Ralph N. Parks, of Charleston, W. Va., I will "have at it."

The story of the marketing of the natural gasoline produced in the Appalachian district is not a long one. Many of the difficulties are a duplication of those with which the Mid-Continent manufacturer is now struggling. These have been discussed so many times in our Mid-Continent meetings that I will only comment briefly on a few of them here. For instance, the refiners of that district now have available the lighter crudes which have done so much to reduce the overall demand for natural gasoline. I can remember from my early refinery experience in Western Pennsylvania what a thrill I got the first time I stood on a tank and saw Oklahoma crude coming into that tank—all the way by pipe line. Now, into that same refinery, and probably into the same tank, comes the lighter East Texas crude, brought to the east coast in tankers and pumped back inland through pipelines. This same refinery in those days was a large user of natural gasoline, but now with its light crude and modern vapor recovery system, it produces within its own boundary all the light volatile fractions it can use.

Has Real Job in Selling Its Output

Now one would think that a district producing only approximately 5 per cent of the total natural gasoline supply of the United States should have no difficulty in disposing of its output but it has a real job on its hands for two principal reasons, namely: (1) The contraction of its marketing territory through the development of water transportation for natural gasoline, which has enabled both the Mid-Continent and California production to take possession of its largest consuming area, the East coast; and (2) the practically 100 per cent spread between the minimum and maximum production of the summer and winter months due to the fact that the great bulk of the Appalachian natural gasoline is manufactured at what it is best described as "utility" plants, and production is in direct proportion to domestic sales of natural gas.

It has been only a few short years ago that Mid-Continent natural gasoline was shipped by rail in large quantities to the refining centers of not only the East coast territory, but also directly to the Appalachian district itself, composed of western New York, western Pennsylvania, western Maryland, West Virginia and eastern Ohio, indicating the inability of the Appalachian production at that time to take care of its own and East coast markets. I think that era is now distinctly labeled by the producer and marketer of natural gasoline and tank car owners as "The Good Old Days."

You have heard at this meeting a paper on the development of water transportation for natural gasoline. Faced with the curtailment of their own market from the causes common to all manufacturers of natural gasoline, it was only logical that the Mid-Continent and California groups utilize this development of cheaper transportation and take for themselves the large East coast market where no natural gasoline, as such, is produced. The sale of the Appalachian production has always been based on Group 3 prices and rail freight rates. Formerly the Appalachian producer allowed the Mid-Continent only that part of his market which returned the least yield to himself in freight differentials under Group 3. Now the Mid-Continent producer can reach the seaboard market by rail to the Gulf coast and by tanker from that point at a transportation cost which practically eliminates the differential which exists by rail. As a consequence the Mid-Continent group now allows those Eastern friends to have only the business in that territory which arises out of emergency demands for quick shipments of small quantities, and at the same time keeps a weather eye on the California brethern.

Retaining Freight Differentials

Having lost this market on the East coast, the Appalachian manufacturer looked over his freight rates again to see where he could go to best advantage; i. e., where he could ship outside of his own district and still retain at least a portion of his freight differentials. Table No. 1 shows representative rates but not exact rates from his territory, as it was necessary to take an average of the freight rates from four principal producing areas within the Appalachian district for comparison with the Group 3 rates to a few principal points.

TABLE 1—SHOWING RELATIVE FREIGHT RATES
(Cents per gallon)

	Appalachian	Group 3	Favorable Differentials
Baltimore	.0206	.0469	+.0263
Marcus Hook	.0222	.0475	+.0253
Bayonne and New York	.0241	.0488	+.0247
Boston	.0284	.0508	+.0224
Toledo, Ohio	.0153	.0356	+.0203
Detroit, Mich.	.0172	.0383	+.0211
Cincinnati, Ohio	.0153	.0330	+.0177
Louisville, Ky.	.0182	.0290	+.0108
Indianapolis, Ind.	.0175	.0290	+.0125
Chicago, Ill.	.0198	.0238	+.0040

You can readily see that the loss of the East coast territory was not only costly in volume of business but also in the most favorable freight advantages. As a consequence shipments from the Appalachian district began to appear at points west and gradually the Group 3 manufacturer has been pushed back out of Ohio, most of Michigan and Indiana. Chicago finds an approximate meeting of the two groups with the edge in favor of the Appalachian shipper, but as yet it has been only occasionally that the latter has been compelled, by the necessity of having to move his gasoline, to give away his cherished freight differential to the extent of meeting competition at this point. The exchange of territories has of course been greatly in favor of the Mid-Continent producer in point of volume, as the East coast district has a vastly greater consumption of natural gasoline than that part of Ohio, Michigan and Indiana which has been taken by the Appalachian producer.

Concerning Production

Now let us turn to the production picture of the Appalachian district, which reveals the other major problems of this group. There has been a slight increase of plant capacity in the district comprising western New York, western Pennsylvania, western Maryland, West Virginia and eastern Ohio during the last year. The Oil and Gas Journal reports a capacity of 693,115 gallons daily as of May 1, 1934, as contrasted to 577,925 gallons daily on May 1, 1933; an increase of 151,190 gallons, practically all of which was in Ohio. The number of plants actually has decreased from 256 to 244

(Continued on Page 61)

*Read before Tulsa meeting of Natural Gasoline Association of America, May 9-11.

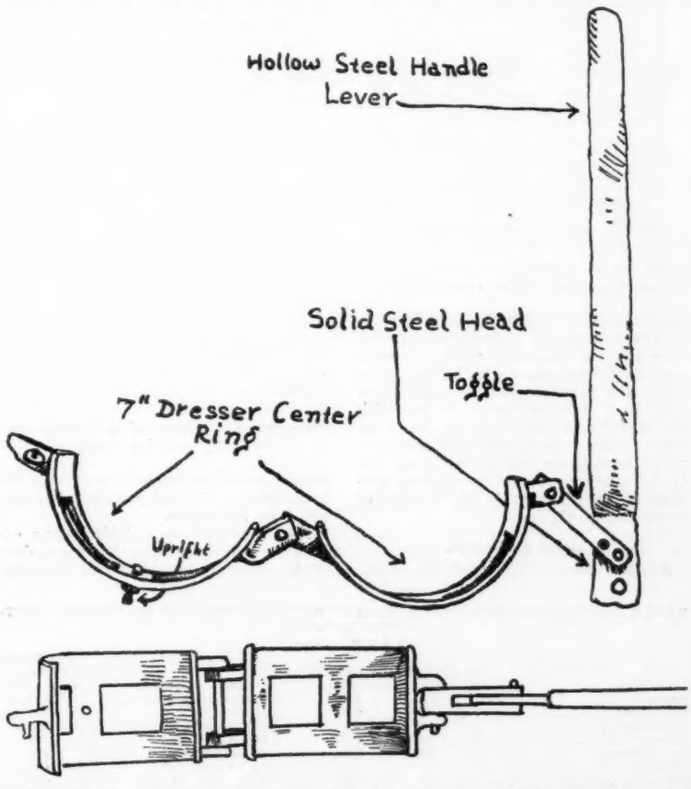
Simple Device Facilitates Welding Pipe Lines and Speeds Up Operations

BY ROBERT C. CONINE

A bundle of worn out inserted working barrel plungers and some Dresser steel couplings speeded up the laying of a 28-mile line of 8-inch welded pipe through sections of Potter and McKean Counties, Pennsylvania, for the Sylvania Corp.

These materials were combined to provide a pipe welding clamp which weighs about 21 pounds and which can be carried easily by one man. In the hill country the matter of aligning pipe ends properly and holding them thus for welding is far from simple, and considerable time may be lost in the work. For the same reasons, equipment used by the men laying the line cannot be cumbersome or heavy without sacrifice of time.

These clamps were constructed from 7-inch center rings of 8-inch Dresser steel couplings. The center rings were split in halves and hinged together on one side. On the opposite sides were arranged the clamping devices. The long hollow steel handle, made from a working barrel plunger, was fitted with a solid steel head. The steel head at a point 3 inches from the end was connected to one of the open ends of the hinged rings through a toggle. When the hinged ring is placed around the ends of 8-inch pipe to be aligned for tacking, the end of the steel head engages with a steel upright member welded to the center of the split ring half hinged to that half holding the toggle bar or handle. The toggle is so constructed that when the clamp has been placed around the pipe ends and properly spaced by wedges attached to the inside of the clamp, the movement of the long handle toward the loose or free end of the split ring clamp and engagement in the aforementioned welded upright produces a clamping effort sufficient to align the pipe ends perfectly. Tack welding is then done through the Dresser coupling openings.



The accompanying diagrams show the construction of one of these clamps. Sizes of Dresser coupling rings to be used will vary, naturally, with the size of pipe to be handled.

Octane Value of Some Economically Important Light Hydrocarbons Within Motor Fuel Range

By F. B. NEPTUNE and H. M. TRIMBLE
Phillips Petroleum Co.*

Although the increasingly abundant light hydrocarbons, particularly the butanes and butenes, have come to occupy a position far from enviable in the motor fuel supply, their superior antiknock qualities have not been entirely unappreciated (1, 5, 6, 7, 8, 9, 16, 33, 34, 37, 38). With increased recognition in recent years of the desirability of seasonal volatility, they have attained some acceptance during the winter months. Believing the weight of evidence has and is continuing to build at least a winter market for these outcasts—for their volatility value, the authors present data in the ensuing paragraphs which it is hoped will add to the knowledge of their

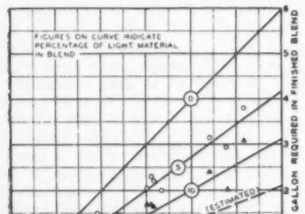

FIGURES ON CURVE INDICATE PERCENTAGE OF LIGHT MATERIAL IN BLEND
ESTIMATED
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Figure 1—Effect of isobutane on TEL requirements

antiknock qualities—an important all-season consideration.

As mentioned before, the antiknock qualities of the light hydrocarbons have been observed and pointed out previously. However, until the adoption of the A.S.T.M.-C.F.R. Motor method of antiknock testing about a year ago, there were so many different testing methods being used, and even the most widely used methods were being modified and changed so rapidly, that any attempts to present data of general application were discouraging, if not impossible. By the time an investigation could be completed and data presented, the favored method had been changed or modified, and even such data as could be presented between changes or modifications were far from universal in application. The comparatively short time the A.S.T.M.-C.F.R. method has been in general use has allowed a considerable wealth of information to be accumulated, largely through inter-company co-operation, made possible by the universality of the method.

Other recent developments of importance are the trend to higher octane ratings for "regular" motor fuels and the general adoption of "Q" Ethyl fluid as a means to this end. As this increase in antiknock quality has been brought about without benefit of premium prices, tetraethyl lead costs have become an important consideration in manufacturing this grade of motor fuel. This paper will point out, among other things, the value of the light hydrocarbons in reducing tetraethyl lead requirements of ethylized motor fuels, which, of course, includes Ethyl as well as "Q" gasoline.

By virtue of the data presented, the advantages of concentrating certain light hydrocarbons and blending these with heavier gasolines to produce motor fuels of suitable volatility and higher antiknock qualities are suggested.

Fenske and others (15, 16, 17) subjected Pennsylvania straightrun gasoline to close fractionation and separated the fractions of high and low knock rating. Their work was done, however, on fractions heavier than pentane, the light fractions being dismissed with the statement, "Those light ends are, of course, very valuable, since their knock rating is zero (74 octane) or better." While it is true that in most cases the normally occurring mixtures of light hydrocarbons in a simple fraction of pentanes and lighter would have such a rating, a mixture in which normal pentane predominated would have a relatively low octane number as will be deducible from the data to be reported later.

Closely allied to the work by Fenske and his associates is the Henderson and Ferris patent (U.S. 1,868,102). This patent groups the fractions boiling below 80° C. (176° F.) as being of such antiknock quality that close fractionation is not required.

The field covered by Henderson and

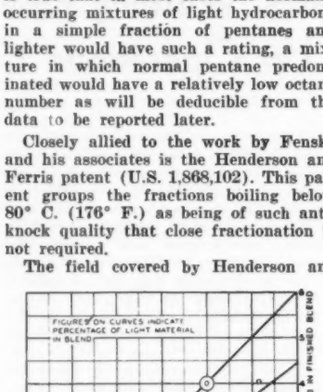
FIGURES ON CURVES INDICATE PERCENTAGE OF LIGHT MATERIAL IN BLEND
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Figure 2—Effect of butane-butylene fraction, TEL requirements

others closely parallels the investigations of Fenske and his co-workers. In each case the experimenters were concerned with the hydrocarbons with boiling points above the pentanes and hexanes. Moreover they were interested in removing the paraffin hydrocarbons, leaving a superior product composed chiefly of aromatic, naphthenic and olefinic structure. If the separation could be effected, pronounced improvement in the quality of motor fuel would result.

Ease of Separation

At the outset of the work to be described it was realized that the improvements to be hoped for in the separation of the lighter hydrocarbons would be less than could be expected in the more difficult province of the heavier hydrocarbons for two reasons.

1. The proportions of light hydrocarbons that can be added are small, being limited by considerations of vapor pressure and in some instances by economic availability.

2. From existing knowledge it was certain that the antiknock values and vapor pressures of the light hydrocarbons were in such directions as to offset their absolute values when blending to limiting vapor pressure specifications.

On the other hand actual commercial experience has demonstrated the economic feasibity of applying fractionation to many of the simple mixtures of the light hydrocarbons. Thus, fairly pure normal butane, iso-butane, normal pentane and iso-pentane have been separated from natural gasoline in quantities of commercial significance.

It thus appeared that here was a field where, although the advantages would be less, the possibilities for actual, practical accomplishments would be greater. From the literature it was to be expected that among the four carbon atom hydrocarbons, normal butane would be quite inferior to all the rest, that iso-

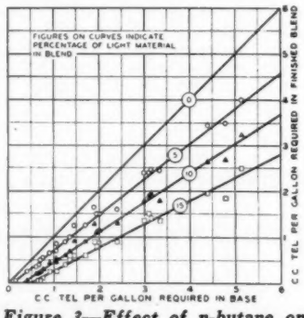
FIGURES ON CURVES INDICATE PERCENTAGE OF LIGHT MATERIAL IN BLEND
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Figure 3—Effect of n-butane on TEL requirements

butane would be superior and that the butylenes would be as good, possibly better, than iso-butane.

No convenient or reliable means existed for translating the theoretical data of the literature into the terms necessary for a practical measure of the antiknock values of the light hydrocarbons.

Plan of Investigation

(a) Definition of terms. For sake of brevity some arbitrary abbreviations have been used, most of which are obvious in meaning or are identified as used. TEL is used for tetraethyl lead; TEL Requirement to mean the number of cubic centimeters of tetraethyl lead to add per U. S. gallon to reach a given octane rating; TEL Equivalent, the amount of TEL (in cc. per U. S. gallon) saved by a given proportion of light hydrocarbon. All percentages shown are volume percentages.

(b) Materials used. The principal characteristics of the base fuels used in the experiment are shown in Tables 1 to 8 inclusive,[1] and data on the nature and origin of the materials studied are summarized briefly here:

Base Fuel A—Low octane number (54) debutanized straightrun gasoline from East Texas crude oil.

Base Fuel B—High octane number (68) debutanized straightrun gasoline from Smackover crude oil.

Base Fuel C—Low octane number (58) debutanized cracked gasoline from Oklahoma crude oil.

Base Fuel D—High octane number (65) debutanized commercial fuel predominantly cracked gasoline.

Propane, Iso-Butane, n-Butane, Iso-Pentane (2-Methyl Butane) and n-Pentane—Cut from Burbank natural gasoline on experimental columns, approximately 99 per cent pure with impurities largely other hydrocarbons.

Butane-Butylene Fraction—Composite

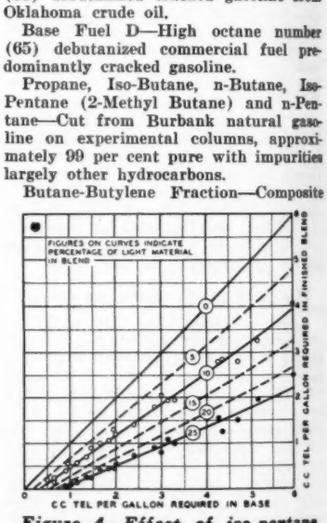

FIGURES ON CURVES INDICATE PERCENTAGE OF LIGHT MATERIAL IN BLEND
CC TEL PER GALLON REQUIRED IN BASE
CC TEL PER GALLON REQUIRED IN FINISHED BLEND

Figure 4—Effect of iso-pentane on TEL requirements

of light ends from several vapor recovery gasolines (38). Composition analysis:

	Gas volume (%)	Liquid volume (%)
Iso-butane	5.4	5.7
n-Butane	60.8	62.0
Butylenes	33.3	31.7
Pentanes	0.5	0.6

Iso-Butylene—Made from tertiary butyl alcohol dehydrated with oxalic acid. Approximate purity 100 per cent.

Butene-1—Made from n-butyl alcohol dehydrated over hot aluminum oxide. Approximate composition:

Butene-1	87%
Butene-2	13%

Butene-2—Made from secondary butyl alcohol dehydrated by 60 per cent sulphuric acid. Approximate composition:

Butene-2	90%
Butene-1	10%

(c) Blending procedure. The labora-

TABLE A—COMPARISON OF C.F.R. ENGINE RATING WITH OLD WAUKESHA TESTING ENGINE
(A.S.T.M. Method)

Fuel—	Octane No.	Compression ratio used	Reference fuels	Previously reported rating (34)
Propane	125	8.15	Benzene and iso-octane	(a)
Iso-butane	99	8.09	Aniline and C-7	100
n-Butane	91	7.35	Aniline and C-7	92
Iso-pentane	90	7.35	Aniline and C-7	91
Iso-butylene	87	7.20	Aniline and C-7	(b)
Butene-2	83	6.39	Aniline and C-7	(b)
Butene-1	80	6.29	Aniline and C-7	(b)
n-Pentane	64	5.32	C-7 and A-3	64

(a) Considerably better than iso-butane. (b) Not reported.

TABLE B—RELATIVE TEL SAVING VALUE OF VARIOUS LIGHT HYDROCARBONS REFERRED TO CONSTANT REID VAPOR PRESSURE OF FINISHED BLEND AT 9 POUNDS
(R.V.P. of debutanized base assumed at 4 pounds)

Light material—	Per cent light material required	Cc. TEL per gallon saved when base fuel requires indicated TEL: 1	2	3	4	5	6
n-Butane	5.25	0.50	0.80	1.10	1.40	1.70	2.00
Iso-butane	6.00	0.50	0.80	1.10	1.40	1.70	2.00
Butane-butylene	5.25	0.50	0.85	1.20	1.55	1.90	2.20
n-Pentane*	38.00	0.40	0.75	1.15	1.55	1.90	2.30
Iso-pentane	26.00	1.00	1.55	2.15	2.75	3.30	3.90

*Estimated—based on 54 octane straightrun (Fuel 1-A). TEL reduction would be greater with lower octane fuels, less with higher octane fuels.

*Presented before Tulsa meeting of Natural Gasoline Association of America, May 9-11.

[1]For explanation of numerical prefixed designating Fuels A, B and C, see section on Blending Procedure.

tory work involving Fuels A, B and C was extended over a considerable period of time. The blends with the pentanes were made and tested several months before the butane blends. To check on possible changes in these base stocks during storage, it was deemed advisable to test them again at the time the butane blends were made. Thus, the older base samples are designated as 1-A, 1-B and 1-C, the latter as 2-A, 2-B and 2-C. All blends with Fuel D were made at one time.

In the blending operation, weathering was reduced to a minimum by chilling

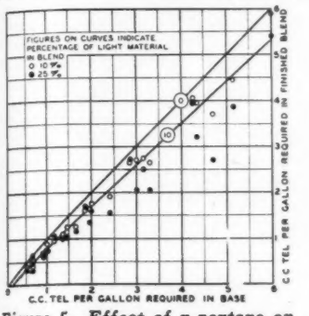

FIGURES ON CURVES INDICATE PERCENTAGE OF LIGHT MATERIAL IN BLEND
0 10 %
0 25 %
CC TEL PER GALLON REQUIRED IN BASE
CC TEL PER GALLON REQUIRED IN FINISHED BLEND

Figure 5—Effect of n-pentane on TEL requirements

the components before exposure to the air. The butane-free base stocks were chilled in an ordinary ice-water bath and poured into the blending containers. The light materials were conducted through carbon dioxide-cooled coils and weighed into the container while the heavy materials were still cold. Measurement was by weighing, using an accurate torsion balance. All percentages shown, however, as mentioned before, are by volume. As soon as all components were in the blending container it was capped tightly, thoroughly shaken and kept in a cool place until testing was under way. Testing was begun as soon as possible after the blends were made.

To protect the sample as much as possible during the testing, the container was never opened at a temperature above 65° F. No analysis was made of the losses that took place in the laboratory handling of the samples. However, since the samples, except those of highest vapor pressure, were handled appreciably below their liquid initial boiling point these losses were undoubtedly small.

(d) Testing methods used. In conducting this experiment, the following testing methods were employed:

Engler distillation—A.S.T.M. D 86-30 (products below 15 pounds vapor pressure) and D 216-32.

Reid vapor pressure—A.S.T.M. D 323-32T.

Antiknock tests—A.S.T.M. D 357-33T

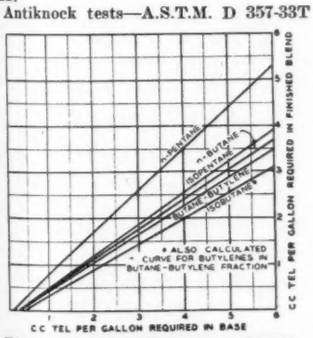


Figure 6—Comparison of TEL savings effected by 10% blends of several light hydrocarbons

and a modified method described below.

Fractional distillation—Usual low temperature procedure.

In determining the octane ratings of the pure hydrocarbons, it was necessary to modify the procedure somewhat because of the high vapor pressures encountered. Such modifications extended only to feeding the test fuel to the engine, it being impossible to use the regular carburetor.

In testing the propane, butenes and butanes, the fuel was conducted (as vapor) from the top of the containing cylinders, through a No. 1 Reynolds type gas regulator where the pressure was reduced to less than 8 ounces. From the

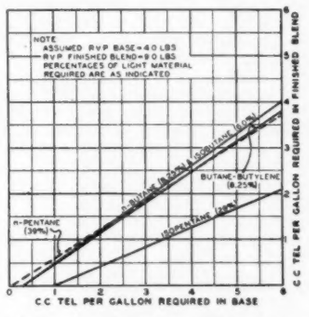

NOTE
ASSUMED RVP BASE=40 LBS
RVP FINISHED BLEND=9.0 LBS.
PERCENTAGES OF LIGHT MATERIAL REQUIRED ARE AS INDICATED
n-BUTANE (8.25%)
BUTANE-BUTYLENE (8.25%)
n-PENTANE (39%)
ISOPENTANE (39%)
CC TEL PER GALLON REQUIRED IN BASE
CC TEL PER GALLON REQUIRED IN FINISHED BLEND

Figure 7—Relative TEL saving value of various light hydrocarbons in blending to constant Reid vapor pressure

regulator the vapor passed through a flow meter consisting of a water-manometer and an uncalibrated orifice large enough to pass sufficient fuel to keep the engine operating. Pressure across the flowmeter, and thus the quantity of fuel fed to the engine, could be controlled either by adjusting the regulator or by a needle valve between the regulator and the flowmeter. In practice it was found more convenient to use the needle valve. It was unnecessary to have a calibrated orifice because no measurements of fuel were made, it being necessary only to vary the air-fuel ratio to find the worst knocking mixture. The only purpose of the graduated manometer was to furnish reference units while determining the worst knocking air-fuel ratio. From the flowmeter the fuel was conducted to the air intake silencer of the C.F.R. engine. It was necessary to drill and tap the air intake silencer and fit it with a copper tubing connection for this purpose.

In testing the pentanes the container was immersed in a hot water bath. Hot water coils were placed between the container and the regulator and between the regulator and the flowmeter. It also was found necessary to immerse the regulator in hot water to prevent condensation in the system. In all other respects the testing was done as with the butanes.

The butane-butylene container was set in a hot water bath with a valve controlled connection from the bottom to the bottom of another cylinder (in the same bath) which served as a flash pot. The vapors were taken from the top of the flash pot through a hot water coil and into the regulator which was immersed in hot water, through the flowmeter and to the engine. Testing procedure was the same as with the other light fuels.

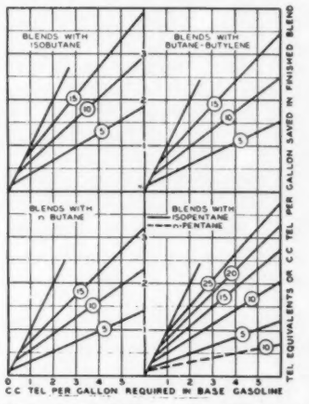

BLENDS WITH ISOBUTANE
BLENDS WITH BUTANE-BUTYLENE
BLENDS WITH n-BUTANE
BLENDS WITH ISOPENTANE
n-PENTANE
CC TEL PER GALLON REQUIRED IN BASE GASOLINE
TEL EQUIVALENTS OR CC TEL PER GALLON SAVED IN FINISHED BLEND

Figure 8—TEL equivalents of several light hydrocarbons

Note: Figures on curves indicate percentage of light material in blend.

TABLES 1 TO 8—TEST DATA ON THE BASE FUELS AND BLENDS OF THE BASE FUELS WITH THE LIGHT HYDROCARBONS

Identification:							
S.S. No.	14,979	17,422	14,883*	17,410	14,931	17,424	18,013*
Base fuels	1-A	2-A	1-B	2-B	1-C	2-C	*A1
A.S.T.M. distillation data:							
First drop (° F.)	132	131	158	157	121	120	112
10% evap. (° F.)	179	176	232	230	174	177	148
50% evap. (° F.)	246	244	325	324	272	275	214
90% evap. (° F.)	344	343	388	388	372	376	322
End Point (° F.)	399	405	428	430	413	419	389
Recovery (%)	98.9	99.0	99.0	99.1	98.0	99.0	98.8
Loss (%)	0.3	0.5	0.6	0.3	1.4	0.3	0.2
% Evap. @ 212° F.	30.3	31.0	5.6	5.3	25.8	25.0	49.0
Gravity (° A.P.I.)	58.8	58.7	46.3	46.1	54.9	54.8	61.7
Reid vapor pressure (Lb.)	3.3	3.5	1.6	1.8	3.3	3.4	5.8
Antiknock (A.S.T.M.-C.F.R.)							
Octane Number	54	53	69	68	58	58	65
Octane No.	cc. TEL required per gallon to equal designated octane Nos.						
62	0.65	0.70	...	...	...	...	...
64	...	...	...	...	0.50	0.60	...
66	1.00	1.05	...	...	...	...	...
67	...	...	...	...	0.95	1.05	...
70	1.45	1.45	...	0.15	1.65	1.70	0.65
72	...	...	...	0.40	2.40	2.40	0.90
73	1.95	1.90	...	...	...	...	...
74	...	...	0.65	0.75	3.30	3.35	1.35
76	3.00	3.00	1.15	1.25	4.70	4.80	2.00
78	4.35	4.40	1.85	1.95	...	...	3.15
80	...	...	2.85	3.10	...	...	5.15
82	...	...	4.25	...	...	...	...
84	...	...	6.00	...	...	...	...
Blends (a) (1=iso-butane, 2=butane-butylenes, 3=normal butane, 4=iso-pentane, 5=normal pentane).							
5%	...	1,2,3	...	1,2,3	...	1,2,3	1,2,3
10%	4.5	1,2,3	4.5	1,2,3	4.5	1,2,3	1,2,3,4,5
15%	...	1,2,3	...	1,2,3	...	1,2,3	1,2,3
25%	4.5	...	4.5	...	4.5	...	1,2,3,4,5

(a) Tables 1 to 8 contain similar detailed test data pertaining to the individual blends. For brevity the tables have been omitted from the publication. The author will provide interested readers with mimeographed copies of the detailed tables on request.

Method of Interpretation

Because of considerable differences in original octane number and lead susceptibility of the several fuels, octane ratings were selected to cover as wide a range of TEL requirements as possible. From the data contained in these tables (5 to 8, inclusive) the basic linear relationships illustrated in Figures 1, 2, 3, 4 and 5 are derived by plotting the TEL requirement of the base gasolines, to the various octane ratings, against the TEL requirements of the blends to the same ratings. As can be seen from the figures, the points are grouped along straight lines whose slope is a function of the concentration of the light material in the blend. The fact that this relationship holds for base gasolines as widely divergent in boiling point, vapor pressure, and antiknock characteristics as those used in this experiment is highly significant, and indicates that it should hold for all normal gasolines. Figure 6 compares the TEL saving effect of equal concentrations of the several light hydrocarbons; however, when vapor pressure limits are considered, we get a somewhat different picture, such as illustrated by Figure 7. The allowable concentrations of light material for the case assumed were read from the vapor pressure charts of Figures 10 and 11.

Figure 8 is a summary chart similar

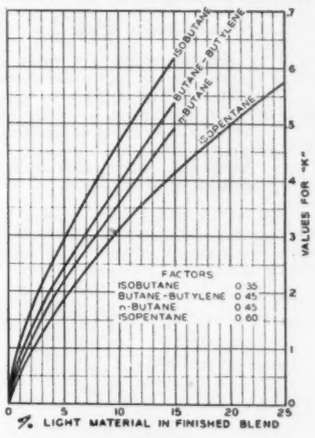


Figure 9—Chart for calculating TEL saved by light hydrocarbons

Note: To find cc. TEL per gallon saved in finished blend by addition of light material, multiply value of "K" indicated for percentage added by number cc. TEL per gallon required in base plus factor indicated in table below.

TABLE 9—TETRAETHYL LEAD EQUIVALENTS OF LIGHT HYDROCARBONS
cc. TEL per gallon saved by following:

cc. TEL per Gallon Required in Base	Normal Butane			Butane-Butylene			Iso-Butane			Normal Pentane	Iso-Pentane				
	5%	10%	15%	5%	10%	15%	5%	10%	15%*	10%	5%	10%	15%	20%	25%
1	0.30	0.55	0.75	0.35	0.60	0.80	0.40	0.65	0.85	0.2	0.30	0.50	0.70	0.80	0.95
2	0.50	0.90	1.25	0.60	1.00	1.30	0.70	1.10	1.50	0.3	0.50	0.85	1.10	1.30	1.50
3	0.75	1.25	1.70	0.85	1.35	1.85	1.00	1.55	2.10	0.4	0.65	1.15	1.50	1.80	2.10
4	1.00	1.60	2.20	1.05	1.75	2.40	1.25	2.00	2.70	0.5	0.85	1.45	1.95	2.30	2.65
5	1.20	1.95	2.70	1.30	2.10	2.95	1.55	2.45	3.30	0.6	1.00	1.75	2.35	2.80	3.20
6	1.40	2.30	3.20	1.55	2.50	3.45	1.85	2.90	3.90	0.7	1.20	2.05	2.75	3.30	3.80

*Estimated.

TABLE 10—PREMIUM VALUE OF SEVERAL LIGHT HYDROCARBONS DUE TO TETRAETHYL LEAD SAVINGS
(Based on TEL cost at 0.35 cents per cc.)
Premium value (cents per gallon) of following:

cc. TEL per Gallon Required in Base	Normal Butane			Butane-Butylene			Iso-Butane			Normal Pentane	Iso-Pentane				
	5%	10%	15%	5%	10%	15%	5%	10%	15%*	10%	5%	10%	15%	20%	25%
1	2.10	1.95	1.75	2.45	2.10	1.85	2.80	2.25	2.00	0.70	2.10	1.75	1.60	1.40	1.30
2	3.50	3.15	2.90	4.20	3.50	3.00	4.90	3.85	3.50	1.05	3.50	2.95	2.55	2.30	2.10
3	5.25	4.45	3.95	5.95	4.75	4.30	7.00	5.45	4.90	1.40	4.55	4.05	3.50	3.15	2.95
4	7.00	5.60	5.15	7.35	6.10	5.60	8.75	7.00	6.30	1.75	6.95	5.10	4.55	4.00	3.70
5	8.40	6.85	6.30	9.10	7.35	6.90	10.80	8.60	7.70	2.10	7.00	6.10	5.50	4.90	4.50
6	9.80	8.05	7.50	10.50	8.75	8.05	12.30	10.00	9.10	2.45	8.40	7.20	6.40	5.75	5.30

*Based on estimate from Table 9.

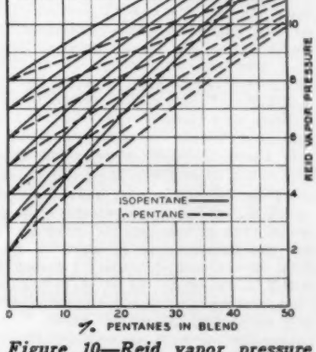


Figure 10—Reid vapor pressure chart for pentanes

to the previous charts except that TEL saved in the finished blend is plotted as a function of the TEL requirement of the base instead of TEL required in the finished blend.

Table 9 consists of values read indirectly from the basic graphs of Figures 1 to 5, inclusive, or directly from Figure 8, and in Table 10 the TEL savings shown in Table 9 are converted to monetary values. Assuming TEL costs 0.35 cent per gallon, the premium value per gallon of the light hydrocarbons for TEL saving considerations alone is calculated from the following simple formula:

$$x = .35a/b, \text{ where}$$

x = the premium value (in cents per gallon) of any particular concentration of light hydrocarbon.
a = cc. TEL per gallon saved as indicated by the figures or Table 9.
b = percentage of light hydrocarbon in the finished blend expressed as a decimal.

The "K" values plotted against percentage light material in Figure 9 are slopes or tangents of the angles formed

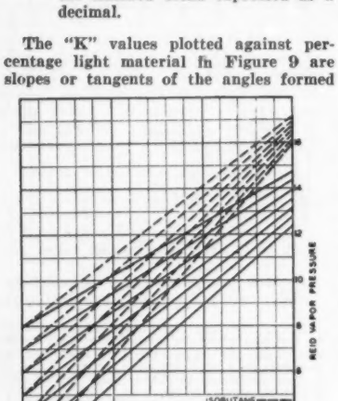


Figure 11—Reid vapor pressure chart for butanes

by the straight line "curves" with the horizontal axis of Figure 8. The addition factor is necessary because the "curves" do not intercept the horizontal axis at zero on the horizontal scale.

Table 11 consists of values read from Figure 9. It summarizes the most important data and should be the most useful of the relationships presented.

Other phases of the investigation, data requiring no particular interpretation, by-product information, and examples in the use of the charts are contained in the following paragraphs.

Results—Discussion

(a) The octane ratings of the pure hydrocarbons. The special handling necessary in testing the light hydrocarbons has been discussed in previous paragraphs. However, once the necessary apparatus was set up, no great difficulty was encountered in rating them. Table A gives the ratings obtained on the A.S.T.M.-C.F.R. unit and compares these ratings with those obtained several years ago on a Waukesha engine operating at 600 r.p.m., 212° F. jacket temperature and spark advance at 20°.

It is interesting to note that the A.S.T.M. ratings are one octane number lower than ratings by the older method for the butanes and iso-pentane. However, in the case of normal pentane, the A.S.T.M. rating is the same as the previous rating, the butane-butylene fraction rated only 84 octane number, indicating the presence, in considerable volume, of butene-1 in the butylene fraction and substantiating phenomena pointed out by other investigators (20) that the blending octane number of the olefins is higher than the actual octane number of the olefin hydrocarbon. It will be shown that the calculated blending value of the butylene in the butane-butylene fraction is equal to iso-butane.

(b) Nonconformity of n-pentane. Of the light hydrocarbons studied, n-pentane is the least desirable from an antiknock viewpoint, although it is quite superior to motor fuels in general. Its comparatively low octane number undoubtedly explains its nonconformity as reflected in Figure 5, where the points representing 25 per cent concentration in the blend are badly scattered. When one considers a fuel such as Fuel B, with 68 octane number, it is easy to see how the displacement of the original (unleaded) octane number of the blend as the concentration of n-pentane is increased will throw relationships, such as shown in Figure 5, out of line. The 10 per cent blend appears to hold, undoubtedly because the concentration of n-pentane is not sufficient to affect the original octane number appreciably.

(c) Use of the charts. As an example of the use of the charts, consider the following case. A refinery gasoline of 6-pound R.V.P. requiring 4.0 cc. TEL to 70 octane number; to be blended to 9-pound R.V.P. with iso-pentane. Following the line representing an original vapor pressure of 6 pounds on Figure 10 to the horizontal line representing 9 pounds vapor pressure of the blend, it is found that approximately 18 per cent iso-pentane would be required. The TEL requirement of the finished blend can be read directly from Figure 4 by following the vertical line representing 4.0 cc. required in the base to its intersection with the line (by interpolation) of 18 per cent light material in the blend. At this intersection the vertical scale indicates that about 1.85 cc. TEL per gallon would be required in the finished blend or a saving of 2.15 cc. due to iso-pentane. The savings also could be read directly from Figure 8 or calculated from the formula,

$$S = K(R + F), \text{ where}$$

S = cc. TEL per gallon saved.
K = constant corresponding to 18 per cent iso-pentane from Figure 9 or Table 11.
f = addition factor for iso-pentane = 0.6.
R = TEL requirement of base gasoline.

Substituting these values,

$$S = .47(4 + 0.6) = 2.16$$

(d) The calculated TEL value of butylenes. Knowing the TEL equivalent of the other hydrocarbons, the TEL equivalent of the butane-butylene fraction as well as its composition analysis, the TEL equivalent of the butylene in the butane-butylene fraction was calculated. Based on 10 per cent concentration blends, the butylenes were found to have the same TEL equivalent as iso-butane. As the vapor pressure of the butylenes is somewhat less than that of iso-butane, their TEL value in blending to a constant vapor pressure should be slightly higher than iso-butane.

(e) A blend with propane. After completion of the work on the blends of the other light hydrocarbons, a single propane blend was made to establish, if possible, a value for this hydrocarbon. As the results gave a value for propane considerably lower than iso-butane it seemed that a more thorough investigation was necessary. Sufficient time did not remain to complete this investigation in time to be presented in this paper.

(f) Relative TEL saving value referred to constant vapor pressure of finished blend. When referred to equal percentages in the finished blend, the TEL equivalents of the several light hydrocarbons have relative values, such as shown in Figure 6. However, when referred to useful percentages within given vapor pressure limits, a somewhat different relationship is presented, such as illustrated in Figure 7 and in Table B, taken from Figure 7.

TABLE 11—MULTIPLIERS FOR CALCULATING TEL SAVED BY LIGHT HYDROCARBONS

Per Cent Light Material in Finished Blend	Addition Factor (1)	Iso-Butane	Butane Butylene	n-Butane	Iso-Pentane
		0.35	0.45	0.45	0.60
		Values of "K" (from Figure 9)			
0		0	0	0	0
1		0.110	0.083	0.068	0.050
2		0.165	0.131	0.110	0.090
3		0.211	0.171	0.149	0.123
4		0.252	0.207	0.182	0.154
5		0.292	0.240	0.214	0.183
6		0.329	0.272	0.245	0.212
7		0.366	0.302	0.273	0.238
8		0.399	0.332	0.301	0.263
9		0.432	0.362	0.330	0.288
10		0.465	0.392	0.358	0.311
11		0.497	0.421	0.386	0.333
12		0.528	0.450	0.412	0.354
13		0.558	0.479	0.439	0.375
14		0.588	0.507	0.465	0.394
15		0.618	0.538	0.492	0.412
16		....	....	....	0.430
17		....	....	....	0.448
18		....	....	....	0.464
19		....	....	....	0.481
20		....	....	....	0.498
21		....	....	....	0.514
22		....	....	....	0.530
23		....	....	....	0.547
24		....	....	....	0.561
25		....	....	....	0.576

(a) To find cc. TEL per gallon saved in finished blend, multiply "K" values by number cc's TEL per gallon required in base fuel plus this addition factor.

TABLE 12—TEL SAVINGS BY BLENDING NATURAL GASOLINE WITH BASE GASOLINES OF VARIOUS TEL RESPONSE

% N.G. in Finished Blend	cc. TEL per Gallon Required in Base Gasoline: 1	2	3	4	5	6	
	cc. TEL per Gallon Saved in Finished Blend						
10	0.10	0.30	0.40	0.50	0.65	0.75	
20	0.20	0.45	0.70	0.95	1.20	1.40	
30	0.30	0.65	1.00	1.30	1.60	1.95	10 lb. N. G.
40	0.40	0.80	1.20	1.60	2.00	2.40	
50	0.50	1.00	1.45	1.90	2.35	2.85	
60	0.60	1.15	1.70	2.20	2.75	3.30	
10	0.15	0.20	0.45	0.60	0.75	0.90	
20	0.30	0.55	0.85	1.10	1.40	1.65	
30	0.40	0.75	1.15	1.50	1.80	2.15	14 lb. N. G.
40	0.60	1.05	1.45	1.90	2.35	2.75	
50	0.70	1.25	1.80	2.30	2.85	3.35	
60	0.80	1.45	2.05	2.70	3.30	4.00	
10	0.15	0.30	0.45	0.60	0.75	0.95	
20	0.35	0.65	0.90	1.20	1.45	1.70	
30	0.55	0.90	1.30	1.70	2.05	2.45	18 lb. N. G.
40	0.70	1.15	1.65	2.15	2.60	3.10	
50	0.85	1.40	2.00	2.65	3.20	3.80	
60	1.00	1.70	2.35	3.05	3.70	4.40	
10	0.20	0.40	0.55	0.75	0.90	1.10	
20	0.40	0.70	1.00	1.30	1.60	1.90	
30	0.60	1.05	1.45	1.90	2.30	2.70	22 lb. N. G.
40	0.80	1.30	1.85	2.40	2.90	3.45	
50	1.00	1.60	2.25	2.85	3.50	4.10	
10	0.20	0.45	0.65	0.90	1.10	1.30	
20	0.50	0.80	1.10	1.40	1.70	2.05	
30	0.70	1.15	1.60	2.00	2.45	2.90	26 lb. N. G.
40	0.85	1.45	2.00	2.55	3.10	3.60	
50	1.00	*1.80	2.40	3.10	3.70	4.40	

*1.00 cc. is saved with less than 50%.

Thus it can be seen that from a practical standpoint, the butanes are about equal in TEL value and slightly less valuable than the fraction containing the unsaturates, and that iso-pentane is most valuable of all. It should be noted that the value of n-pentane is based on a special case.

Summary and Conclusions

Four base fuels of widely divergent characteristics were selected and reduced to a butane-free condition. To these butane-free base stocks, various light hydrocarbons (five or less carbon atoms) were added in various percentages within practicable vapor pressure limits. The bases and blends were studied principally in terms of antiknock effects, although other inspection data are included, as well as two vapor pressure charts.

A.S.T.M. octane numbers were determined on the pure hydrocarbons as follows:

Propane	115
Iso-butane	99
n-Butane	91
Iso-pentane	90
Iso-butylene	87
Butene-2	83
Butene-1	86
n-Pentane	64

The necessary special handling in knock testing the pure hydrocarbons is described.

Considering equal concentrations of the light hydrocarbons in the finished blend, their values in reducing TEL requirements are indicated as being in the following order: (most valuable first)

1. Iso-butane.
2. Butane-butylene fraction.
3. n-Butane.
4. Iso-pentane.
5. n-Pentane.

Referred to a constant vapor pressure in the finished blend or where the amount of light material that can be used varies inversely with its vapor pressure the TEL values are indicated as being in this order: (most valuable first)

1. Iso-pentane.
2. Butane-butylene fraction.
   n-Pentane (with low octane number base fuel).
   n-Butane and iso-butane.
3. n-Pentane (with high octane number base fuel).

The TEL saving value of each light hydrocarbon studied in this experiment falls into a definite bracket, and from charts and/or tables presented as part of this paper, it is easy to predict values

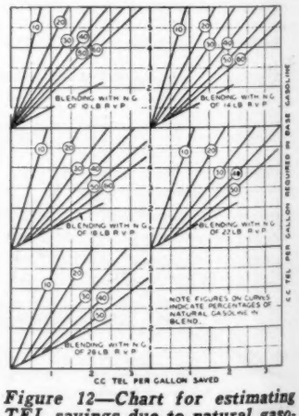
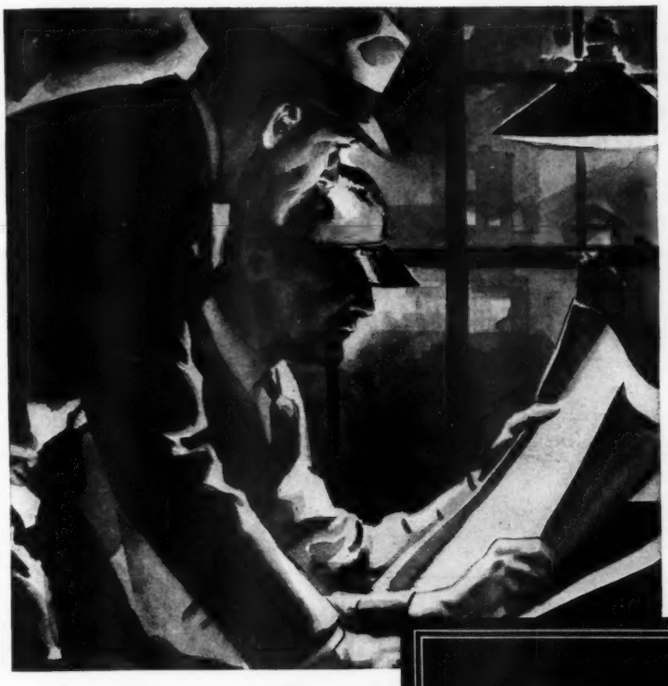

BLENDING WITH N.G. OF 10 LB R.V.P.
BLENDING WITH N.G. OF 14 LB R.V.P.
BLENDING WITH N.G. OF 18 LB R.V.P.
BLENDING WITH N.G. OF 22 LB R.V.P.
BLENDING WITH N.G. OF 26 LB R.V.P.
NOTE FIGURES ON CURVES INDICATE PERCENTAGES OF NATURAL GASOLINE IN BLEND
CC TEL PER GALLON REQUIRED IN BASE GASOLINE
CC TEL PER GALLON SAVED

Figure 12—Chart for estimating TEL savings due to natural gasoline

for the finished blend. In fact, all predictions or estimations can be made from a single chart (Figure 9) or a single tabulation (Table 11) when the TEL requirement of the base gasoline and the amount and composition of light material to be added are known.

Because of its low unleaded octane number, relative to the other light hydrocarbon, the value of normal pentane is a function of the octane number of the fuel with which it is blended and therefore cannot be assigned a fixed value as

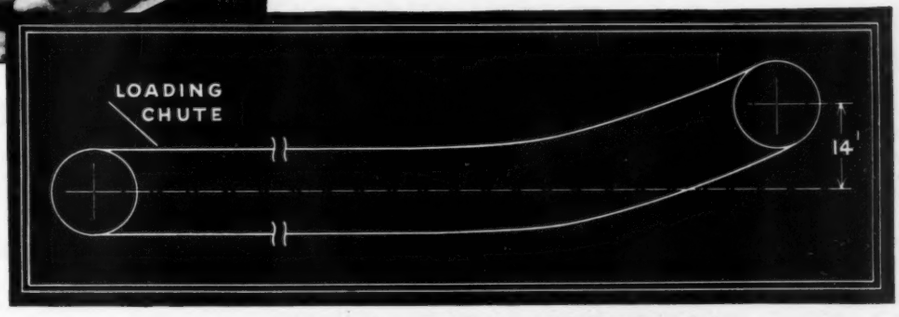
IN A HOT SPOT FOR 4 YEARS



GOODYEAR HY-TEMP CONVEYOR BELT STILL ON THE JOB HANDLING SLAG

A G.T.M. SPECIFICATION

Record of 406,155 tons to date and Belt is still in working condition



G. T. M. specified Goodyear H-T Conveyor Belt 828', 30" x 5-ply, for Duquesne Slag Products Company, Pittsburgh, Pa.

DUQUESNE Slag Products Company, of Pittsburgh, Pa., points to a veteran conveyor belt in its plant as the best of reasons for standardizing on Goodyear Hy-Temp Belts.

This particular conveyor belt has given Duquesne what the user considers exceptionally good service with a minimum of trouble and at very low cost.

Its job all along has been a real test of belt stamina, too.

G.T.M. RECOMMENDED HY-TEMP

Four years ago last February, Duquesne asked the G.T.M.—Goodyear Technical Man—to analyze their slag conveying installation and submit his recommendations.

As he always does, the G.T.M. made a careful study of the operating conditions. He noted that the belt would be called on to carry slag, frequently at comparatively high temperatures.

The Goodyear Style H-T Conveyor Belt (828 feet long, 30" by 5-ply) which he specified has now handled 406,155 tons in its four years of duty *and is still in fair condition.*

You can have the same efficient, trouble-free, cost-reducing service from your conveyor or power-transmission belts by getting the *right* equipment, accurately specified and scientifically built for your operations.

Why not discuss your requirements for belts and hose with this practical expert who knows rubber and its many uses in industry? He is readily available through Goodyear, Akron, Ohio, or Los Angeles, California, or your nearest Goodyear Mechanical Rubber Goods Distributor.

BELTS • MOLDED GOODS
HOSE • PACKING
MADE BY THE MAKERS OF GOODYEAR TIRES

THE GREATEST NAME IN RUBBER

GOODYEAR

NRA

in the case of the other light hydrocarbons.

Based on TEL cost at 0.35 cent per cubic centimeter, the premium value (for TEL savings alone) of equivalent proportions of the other light hydrocarbons studied in this experiment is: (see Table 10)

n-Butane—from 1¾ to 9¾ cents per gallon.
Butane-butylene fraction—from 1¾ to 10¾ cents per gallon.
Iso-butane—from 2 to 12¼ cents per gallon.
Iso-pentane—from 1¼ to 8½ cents per gallon.

From several viewpoints a number of rather surprising facts have been demonstrated or confirmed:

1. The unblended octane numbers of the four carbon olefins are considerably lower than their "blending" octane numbers.

2. When blended in equal proportions, the light hydrocarbons fall in about the same order in antiknock effects as would have been expected from the literature.

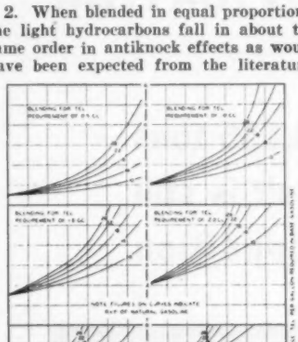


Figure 13—Chart for blending to lower TEL requirements using various percentages of various r.v.p. natural gasoline

However, the differences are not as great in all instances as might have been expected.

3. When blended in equal proportions, there is a considerably greater difference between the antiknock effectiveness of the iso- and normal pentanes than between the iso- and normal butanes.

4. When blended in equal proportions, the composite refinery butanes-butylenes was practically identical to the natural gasoline butanes which usually contains considerable iso-butane.

5. When blended to finished products of equal vapor pressure, normal and iso-butane are almost identical in antiknock effectiveness.

6. When blended to finished products of equal vapor pressure, the composite refinery butanes-butylenes was only slightly superior to mixtures of the paraffinic butanes.

7. When blended to products of equal vapor pressure, iso-pentane is decidedly superior to any of the other light hydrocarbons or mixtures of light hydrocarbons studied.

8. The small proportions of four carbon atom hydrocarbons present in commercial motor fuels have been responsible for considerable improvement in the antiknock properties of ethylized motor fuels.

9. Further increases in the proportions of four carbon atom hydrocarbons, now prevented by careless design of automotive fuel systems, can bring about notable improvement in the antiknock properties of ethylized motor fuels.

Closely related to the foregoing discussion of the antiknock qualities of certain light hydrocarbons, but unquestionably more directly interesting to natural gasoline men, is an experiment recently completed in Phillips' motor fuel laboratory concerning the antiknock qualities of natural gasoline.

In that experiment four base gasolines were blended with two grades (R.V.P. basis) of natural gasoline and from the data obtained, TEL equivalents and hence premium values were assigned for the five R.V.P. grades.

Blending, testing and interpretation of data were handled exactly as in the case of the light hydrocarbons just described except such modifications as were made necessary by the difference in the nature of the light components.

The work on natural gasolines is summarized in Figures 12 and 13 and Table 12. From what has gone before, the use of the charts should entail no difficulty, however an example in predicting from the chart of Figure 13 might lead to clearness. Assume a refiner has a product which requires 4.0 cc. TEL per gallon to the octane rating desired in the finished blend, and he wishes to reduce the requirement of the finished blend to 2.0 cc. Reading along the horizontal line representing 4.0 cc. required in the base on the section of chart indicated for blending to 2.0 cc., it can be predicted that the desired TEL reduction can be made with

52% 10 lb. N.G. in the blend
42% 14 lb. N.G. in the blend
37% 18 lb. N.G. in the blend
33% 22 lb. N.G. in the blend
30% 26 lb. N.G. in the blend

Figuring the premium value of natural gasoline for antiknock considerations alone, employing the formula brought out previously, the various grades are indicated as being worth (over and above the price of refinery gasoline of like octane rating) about one-half to more than 4 cents per gallon.

Acknowledgments

The authors gratefully acknowledge the assistance of various members of Phillips' research staff in conducting this experiment. The antiknock tests, upon which the bulk of the experiment is based, were run by R. R. Couch. The blending was done by E. F. Glasgow. Appreciation is due Dr. R. D. Snow and V. Mertz for preparation of the pure hydrocarbons, to R. C. Alden and T. W. Legatski for constructive criticism of the manuscript and to the several members of the motor fuel laboratory who assisted in the various routine testing involved.

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Field and Plant Workers of Two Companies in Greater Seminole Field Go on Strike

Seven hundred and twenty employes of the Sinclair Prairie Oil Co., working on leases and in the four gasoline plants of the company in the Greater Seminole Field in Oklahoma were called out on strike in the past week. Of the number who walked out 317 were members of the recently organized oil field and refinery workers' union. The others, 403 in number were, it is said, forced off their jobs by the union employes. It is said that not all of the union men favored the strike, but that at a meeting held previous to the walkout 180 favored striking and the others voted against it.

Four hundred and sixty-four wells of the Sinclair Prairie Oil Co. were completely shut down, affecting an average of over 16,000 bbls. per day production. The four natural gasoline plants have of late been manufacturing about 80,000 gallons per day of gasoline from casinghead gas.

What effect the shutting in of the wells will have on their production when they are reopened cannot be foretold. Superintendents of the Sinclair Prairie Oil Co. confessed they did not know.

At the Tulsa offices of the company The Oil and Gas Journal was told that no statement could yet be given out as to what the company would do to make up for the crude oil shut in. The natural gasoline made by the company goes into its own refinery operations and will have to be procured elsewhere while the shutdown is on, but officials said they did not yet know from what source.

On Sunday, 112 Skelly Oil Co. employes in the Seminole area were forced to quit work when a number of employes of the company went on a strike affecting all Skelly operations in the field, including field work and natural gasoline plant operations.

The Skelly Oil Co. produces about 1,800 bbls. of crude oil per day in the Seminole area, all of which is now shut in, and its gasoline plants have been manufacturing 8,000 gallons per day of casinghead gasoline.

Officials of the Skelly Oil Co. claimed on Monday morning that their loyal men were forced off the properties by threats of violence, and that superintendents were forced to give up their keys, and that the gasoline plants and production offices of the company were locked up and picketed.

Jack Grisso, reported chairman of the company's employes' strike committee, wired W. G. Skelly 24 hours after the strike was called asking that the company appoint representatives to discuss the reopening of the plants in the Earlsboro area with representatives of the strikers and that the meeting be held in Seminole.

Mr. Skelly's Attitude

Mr. Skelly's reply to Mr. Grisso follows:

"We will not hold any negotiations until our plants and properties are released from present unlawful trespass and our men are free from attempted intimidation in returning, if they so desire, to normal work under regular authority of our superintendents.

"At that time and in accordance with traditional company policy we will be glad to discuss with our employes, or any of them or their accredited representatives, at any convenient time and place, any matters of mutual interest including working conditions and we will make such decisions regarding any such matters discussed as may then seem right and proper in light of all facts.

"It should not be hard for any employe to see that this is the correct way.

"Appeals to force such as were invoked against us yesterday are damaging to friendly relations and accomplish nothing constructive.

"Skelly Oil Co. has had no controversy with its employes. No request by any employes for a conference was made to us before the unfortunate demonstration yesterday in which without notice a band of outsiders forcibly shut down and took possession of our plants and properties and drove our men from their posts of duty."

Lon Code, a welder, is chairman of the strike committee that brought about the strike of the Sinclair Prairie workmen. His demands upon the company included recognition of the union, an eight-hour day, a closed shop policy, the continuation of the tentative agreement of April 8, and the reinstatement of 13 men said to have been discharged and the restoration of the 1929 scale of wages.

No negotiations for the settlement of the Sinclair Prairie strike have been held. Daniel T. Pierce, assistant to the chairman of the board of the Consolidated Oil Corp., the Sinclair Prairie parent company, said on Monday that if there had been any contact between the union men and the company it was news to him.

There appears to be no signs of a strike in the Oklahoma City Field, but union officials say Oklahoma City union oil workers are in sympathy with the union men in Seminole.

Some Seminole rig builders joined the McPherson County, Kansas, rig builders who went out on strike for a $2 increase in their daily wages.

TECHNICAL MEETING

The Research Committee of the American Association of Petroleum Geologists will hold an open meeting in the Tulsa Building, Fifth and Cincinnati Streets, Tulsa, at 9:30 a.m. Saturday, May 19, to discuss "Geological Changes in Petroleum Reservoirs Affecting Recovery." The meeting is called by C. V. Millikan, Amerada Petroleum Corp., Tulsa, as chairman. Other members of the committee are R. S. Knappen, Gypsy Oil Co., Tulsa; A. M. McCoy, Ponca City, Okla.; M. G. Cheney, Coleman, Tex., and Dr. Raymond C. Moore, University of Kansas, Lawrence, Kans.

DRILLING WAGE RATES

WASHINGTON, D. C., May 8.—Minimum wage rates for employes engaged in drilling operations, which were made effective March 20, 1934, were today made retroactive to September 2, 1933, for employers of drilling contractors whose activities were not incorporated into the petroleum code until December 21, 1933.

Gasoline stocks are mounting—but what kind of gasoline?

Straight-run, half-cracked, knocking gasoline—that's the kind that goes to storage

But not Dubbscracked gasoline

Buyers look for Dubbscracked gasoline and buy it—and pay the price for it and ask for more

Universal Oil Products Co
Chicago Illinois

Dubbs Cracking Process
Owner and Licensor

NEWS FROM FOREIGN LANDS

GREAT BRITAIN

Imports of crude oil and refinery products into Great Britain the first quarter of this year increased approximately 10 per cent reflecting a substantial gain in demand for all products with the exception of gasoline. The imports for the first three months of this year totaled 648,100,000 Imperial gallons which compares with 591,906,000 gallons for the same period in 1933. The following table gives the imports by products (data in Imperial gallons, 35 gallons to American barrel of 42 gallons):

	First quarter 1934	First quarter 1933
Gasoline	263,553,000	265,736,000
Kerosene	68,021,000	51,508,000
Fuel oil	24,278,000	20,696,000
Gas oil	36,164,000	25,911,000
Crude oil	150,562,000	138,773,000
Miscellaneous	6,202,000	2,299,000
Total	648,100,000	591,906,000

Reflecting in part the increased value of the British pound in relation to the American dollar the value of the imports the first quarter of this year was 8,020,769 pound Sterling which compares with 8,250,326 pound Sterling for the same period in 1933. It will be noted in the table that the imports of all refinery products showed a substantial gain with the exception of gasoline, the large increase in kerosene and fuel oil being especially noteworthy.

The output of refineries in Great Britain furnishes relatively little of the total oil products required. Imports of crude oil have increased so far this year but still accounts for less than 15 per cent of the total oil consumed. The crude imports averaged 31,400 bbls. daily the first three months of this year and 27,600 bbls. daily the same period in 1933. The bulk of the crude imports come from Persia and are refined at the plants of the subsidiaries of the Anglo-Persian Oil Co., Ltd.

The following table gies the imports by countries for the first three months of 1934 and 1933 (data in Imperial gallons):

Gasoline—	First three months 1934	First three months 1933
Dutch West Indies	105,309,000	92,891,000
Persia	41,938,000	54,773,000
United States	38,524,000	34,543,000
Mexico	17,237,000	9,105,000
Rumania	14,994,000	27,532,000
Russia	11,987,000	19,824,000
Dutch East Indies	11,369,000	5,910,000
Miscellaneous	12,725,000	12,277,000
Kerosene—		
United States	26,705,000	8,781,000
Persia	20,312,000	19,038,000
Rumania	10,247,000	10,961,000
Mexico	4,352,000	3,204,000
Russia	2,586,000	6,205,000
Fuel oils—		
Dutch West Indies	78,470,000	70,497,000
Mexico	28,974,000	26,743,000
Persia	13,598,000	21,785,000
British West Indies	11,651,000	6,127,000
Rumania	8,230,000	2,592,000
United States	7,366,000	5,879,000
Russia	828,000	2,615,000

FRANCE

A recent survey shows that 13 refineries are operating in France with one plant under construction and a third planned with construction to start in the near future. At Donges, Pechelbronn-Ouest is building a plant which will have crude oil topping and cracking facilities. It is expected that the plant will be ready to operate by September. The owners are affiliated with Pechelbronn Societe Anonyme D'Exploitations Minieres, a subsidiary of which has a refinery operating at Merkwiller. This is a complete refinery.

At Martigues on the Mediterranean the Cie Francaise de Raffinage, a subsidiary of Compagnie Francaise des Petroles the principal French company in which the French government owns stock is considering the construction of a refinery. It had been planned to build this complete refinery and have it ready to operate by next fall. Plans are indefinite at this time. The company has a plant in operation at Gonfreville on the Seine River.

The names of the companies, location and type of refineries are given in the following list:

Franco Americaine, Port Jerome (on the Seine River), complete.

Ste des Petroles Jupiter (two plants), Petit-Couronne (on the Seine River), complete; Pauillac (Gironde), topping and cracking.

Ste Gle des Huiles de Petrole (two plants), Courchelettes (Nord), complete; Lavera (on the Mediterranean), complete.

Vacuum and C.I.P. (two plants), Port Jerome, complete; Frontignan, topping and cracking.

Cie Fse de Raffinage, Gonfreville (on the Seine River), complete.

Pechelbronn, Merkwiller (Bas-Rhin), complete.

Raffinerie du Nord, Dunkirk, complete.

Consommateurs de Petrole, Donges, complete.

Raffineries de Berre, Etangs de Berre, complete.

Raffineries de la Gironde, Bec-d'Ambes (Gironde), topping and cracking.

ITALY

The Azienda Generale Italiana Petroli (A.G.I.P.) has revised its drilling program and now plans to drill 90 tests over the next five years. Drilling is to be expected to exceed 300,000 feet during this period.

The company which is controlled by the government will drill a number of tests based on recent geological surveys which have been made over the past two years. The drilling will vary from shallow wells to tests over 5,000 feet. Sixty-two of the tests will be drilled in northern Italy and 28 in southern Italy including Sicily.

GERMANY

Imports of crude oil into Germany showed a small increase in February over February, 1933, but inshipments of refinery products decreased. The imports for February are given in the following table:

(Data in tons)

	February 1934	February 1933
Crude oil	25,540	22,042
Gasoline	70,502	107,730
Kerosene	11,567	23,714
Gas oil	38,295	48,234
Lubricants	24,049	32,190
Fuel oil	23,290	26,557
Total	193,233	260,467

VENEZUELA

The crude oil production of the Colon Oil Corp. (Shell) in Venezuela the first quarter of this year shows a decrease when compared with the same period in 1933. The first quarter production totaled 1,493,000 tons which compares with 1,773,900 tons for the first quarter of 1933.

The Quiriquire Field in the District of Piar, state of Monagas in eastern Venezuela, is attracting considerable attention due to the increased production. While production in some of the older pools of Venezuela has shown declines so far this year when compared with the same period in 1933, the present production of the Quiriquire, totaling approximately 32,000 bbls. daily, is 10,000 bbls. a day greater than it was at the close of 1933 and 100 per cent greater than the average for all of 1933.

A year ago drilling was stopped due in part to the low prices prevailing for crude oil and the lack of facilities for loading ocean tankers readily. A new export terminal for loading tankers was recently completed by the Standard Oil Co. of Venezuela (Creole Petroleum Corp.) at Guiria on the southern coast of the Paria Peninsula in the District of Marino. Oil is brought to this terminal from Caripito by shallow draft tankers. Caripito is the loading point for the field. Drilling was resumed last August and since that time there has been a steady development.

Since the first of the year repressuring operations for old wells has been expanded and several new wells have been completed. It is understood that the Standard company, the only producer in the field, expects to steadily expand the Quiriquire operations.

The Mene Grande Field is another of the smaller pools in Venezuela to show an increase in production this year. The production of this field which is located in the District of Sucre, state of Zulia, is now averaging approximately 40,000 bbls. daily, which compares with a production of 31,000 bbls. daily a year ago. Six wells are reported to have been completed in the field in recent months.

The production in Venezuela considering the entire country is upward so far this year. For the first two months of this year crude oil production of all fields averaged 350,000 bbls. daily which compares with an average of 316,000 bbls. daily for the same period in 1933. Practically all the production comes from the subsidiaries of the Royal Dutch-Shell. the Standard Oil Co. (New Jersey) and the Gulf Oil Corp. At present the production of the Shell and Standard subsidiaries is approximately the same. The following table gives the approximate production of the companies in February compared with February of last year (daily average in barrels):

	February 1934	February 1933
Venezuela Oil Concessions, Ltd.*	90,000	83,700
Caribbean Petroleum Co.*	40,800	31,400
Colon Developm't Co., Ltd.*	16,800	21,000
Lago Petroleum Corp.†	104,000	100,000
Creole Petroleum Corp.	53,000	39,600
Venezuela Gulf Oil Corp.‡	41,500	27,400
British Controlled Oilfields, Ltd.	3,000	3,850

*Royal Dutch-Shell subsidiary.
†Standard Oil Co. (New Jersey) subsidiary.
‡Gulf Oil Corp. subsidiary.

RUMANIA

The threat of Iraq crude oil which will be made available not later than next fall is causing considerable concern in Rumania which at present is second to Russia among the oil-producing countries outside of the Americas, in furnishing refinery products for European markets. It has been advocated officially that a conference be held immediately for the purpose of allocating the Iraq production which will probably total around 75,000 bbls. daily within a year and will be made available at two Mediterranean terminals of a pipe line now under construction.

The situation is of special concern to Rumania due to the fact that approximately 80 per cent of its crude oil production finds its way into foreign markets either in the form of crude oil or refinery products. Those in charge of Rumanian oil operations also are advocating that either the present rail charges on tank car movement of products be reduced or a pipe line be built to Constanza. The latter project has been under consideration for some time as the more effective way of reducing the cost of Rumanian products at a seaport for foreign shipment. The officials also are advocating that some of the present taxes imposed on the oil industry be reduced so that its competitive position will be strengthened in competing with Iraq and other foreign crude oils.

Rumanian exports increased materially in 1933 according to data recently released by the government. The following table gives the exports for 1933 and 1932; (data in tons):

	1933	1932
Motor spirits	1,757,216	1,639,228
Kerosene	950,801	920,891
Gas oil	1,040,702	887,157
Lub oil	59,361	58,208
Fuel oil	1,791,415	1,469,433
Paraffin wax	5,602	4,569
Pitch	43,300	39,844
Crude oil	235,262	146,882
Total	5,883,659	5,166,457

The 10 principal buyers of Rumanian products in 1933 and 1932 are as follows:

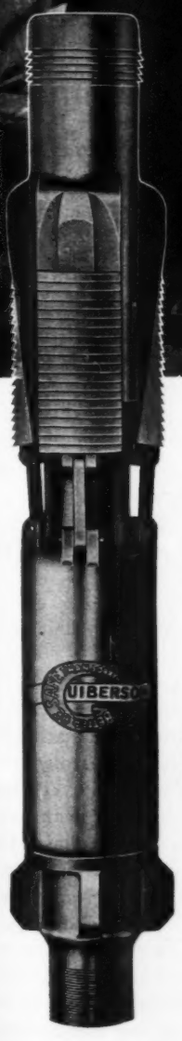
	1933	1932
England	985,992	1,128,962
Italy	903,996	765,125
France	741,442	713,934
Egypt	588,059	484,149
Austria	314,026	238,198
Germany	214,041	171,390
Holland	209,300	45,965
Spain	196,016	219,904
Hungary	183,893	139,414
Belgium	149,836	60,168

MEXICO

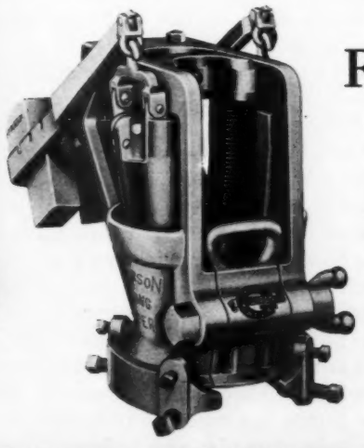
Review of all petroleum concessions that oblige holders to perform exploitations, exploration and other work has been ordered by the Mexican Ministry of National Economy which states it has ascertained that many of these concessions are being used for speculations disadvantageous to Mexico. Concessions found to be purely the basis of speculation will be cancelled and their lands added to the national petroleum reserves, the ministry says.

General view of Cartagena, Colombia, with Andian National Corp's new office building in center background

In photo, left to right: J. C. Owen, Guiberson representative; Leo Bower, Norman Trout, Bill Postman, E. W. Humphrey, Bill Henson, driller, Garland Davis, Noel Black, Murray J. Wells, geologist, H. R. Standlee, Guiberson representative.



GUIBERSON DUPLEX CATCHER ready to run thru GUIBERSON TUBING SPIDER on Famous Binger 10,000 Ft. Well



The Guiberson "Type E" Swab, and "Type E" Tubing Catcher, were used on this well, in addition to the equipment shown in the photograph.

The extensive use of Guiberson equipment on this deep well is convincing evidence of the knowledge and experience incorporated in the positive safety features of Guiberson Tools.

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THE OIL AND GAS JOURNAL

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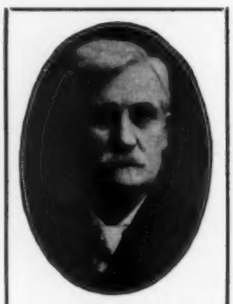

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World Fair of the Oil Industry

The keen expectancy which awaited the opening of the first International Petroleum Exposition in Tulsa in 1923 is recalled by the interest being shown in the eighth exposition which will open in Tulsa Saturday, May 12, the first in three and a half years.

The interval since the exposition of 1930 has been history making in the oil industry as in the world at large. We have learned a lot in those three and a half years, in economics, in exploration, production, manufacturing, transportation, and marketing. Just how much is shown by where the emphasis is placed in the exhibitions displayed at the 1934 exposition in contrast to those of 1930.

The viewpoint of the buyer is different. He is more in the mood where he must be shown. And manufacturers of equipment and supplies, realizing this, have been at special pains to use the Tulsa exposition to show him how much they have accomplished towards satisfying his requirements and meeting his needs.

It may be said without exaggeration that, from this standpoint, the displays will be found one hundred per cent new; or so improved as to be practically new. An outstanding feature is the use of special alloys for the purpose of making the equipment fit exactly the uses to which it is to be put with the best possible results.

This, in fact, will be found to be the keynote of the whole exposition, the extent of the efforts to which manufacturers have gone in the way of supplying exactly the type of equipment for each particular purpose that will prove most satisfactory to the user, be his problem what it may.

Those who have seen previous shows and have had an opportunity to compare the present declare that the 1934 exposition will be a revelation to visitors.

The International Exposition in Tulsa has acquired world fame in other years for its representative character. It was a veritable "World Fair of the Oil Industry". The scope has been broadened this year to take in not only production, manufacturing and transportation but also distribution, giving the visitor an intimate view of the entire industry from the well to the filling station, or rather from the geophysical survey to the motorist's engine.

A visit to the exposition will be a real education to many in the industry who know only their own branch and cannot fail to broaden their understanding and increase their usefulness.

The original idea of a decade ago of a world petroleum congress has been modified and improved by experience into a more practical program. Instead of general addresses, meetings of special interest have been scheduled by various organizations, petroleum engineering students, the Oklahoma section of the American Chemical Society, the petroleum division of the American Institute of Mining and Metallurgical Engineers, the petroleum division of the American Society of Mechanical Engineers, the annual meeting of the Mid-Continent Oil and Gas Association, the mid-year meeting of the Independent Petroleum Association of America, and a research symposium under the auspices of the Association of Petroleum Geologists.

In addition there will be the special meeting of marketers, jobbers and dealers with refiners, the safety meeting and the scientific and technical open forum and others.

No phase of oil interest has been overlooked in the arrangements by the exposition management to make the 1934 International Petroleum Exposition at Tulsa the most comprehensive and interesting yet staged. This we believe will be the verdict of every visitor.

Federal Control Necessary

The efforts of the Texas Petroleum Council and other associations to compel the regulatory authorities in East Texas to show the results of the enforcement they claim to be making have not been very productive.

On the contrary there are complaints that there are less records available while the claims of reduction of hot oil are said to mean only a reduction from the peak of around 75,000 barrels to an average of about 55,000 barrels.

Reduction of excess production in East Texas will have to be away below the average, rather than only below the peak, to mean any real progress in curtailment.

Insistence upon the enforcement agencies showing actual results may be sidestepped for a time but if kept up must in the end educate Texas public opinion. The doubt is whether that will be in time to be of service in this emergency.

It is this situation which deflates all the clamor about state's rights being directed to Congress against any form of Federal control.

As one Texas daily newspaper told Texans, if they are so anxious to guard the state's rights against Federal interference they ought to insist that the state's rights be exercised. It is only because of the evident impossibility of enforcing state regulation that Federal control is being asked.

Abdication is the only threat to the sovereignty of Texas.

Congress would know this if it examined the record instead of listening to sponsored announcers.

That is the alternative before Congress. On the one hand they have Administrator Ickes, the Petroleum Administrative Board, representing the government, and the Planning and Coordination Committee, all of which have been striving to perfect a petroleum code. On the other a half dozen individuals who have opposed every step of the program or have been engaged in putting obstacles in the way.

Any member of Congress who is fooled into thinking he is championing the downtrodden or defending state's rights by listening to that sort of stuff is ignoring the responsible administration approved by the President and the accepted representatives of the industry.

Perhaps the danger is not so much of a majority of Congress being fooled as it is that Congress may not be aroused to the necessity for doing something. Unless the oil industry shows at least as much activity in putting its case before Congress as the handful of objectors the Federal legislation may be postponed until next session.

This is exactly what the opposition wishes. If Congress ad ourns without action what check will there be on East Texas?

Without such check East Texas may continue to menace the whole market during the main consuming season, and experience has shown what that means.

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The Modern BRIDGE

Here, expansion and contraction are provided for by rollers, rockers, sliding bearings, or other dependable means. All longitudinal movement may be concentrated at one spot.

The Modern ROAD

Here, expansion and contraction are provided for at short, regular intervals by joints between slabs, because all longitudinal movement cannot be concentrated at one spot.

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DRESSER COUPLINGS

Gasoline in Group 3 Experiences Sharp Rise and Then Seems Undecided Which Way to Go

By T. F. SMILEY

Following its idle doze the refinery gasoline market in Oklahoma (Group 3) territory woke with a start, began climbing busily, and after a brief period of hesitation early this week there were reasons for believing it might go higher.

Several factors seem to have contributed to the renewal of activity, signs of which were discernible Thursday of last week, when 3⅝ cents became the rock-bottom resale price of low octane U. S. Motor material, previously going at 3½ cents. There was free buying at the higher price. So there was the next day, when another eighth was annexed. Saturday offerings were few at 3⅞ to 4 cents.

Some Mid-Continent refiners put in a few relatively small orders, and this gave rise to rumors of "heavy buying." Jobbers came into the market and a few marketers are suspected of having done some short selling. Monday of this week the lowest resale price reported for third grade gasoline was 4 cents. But not much business was said to have been done at that figure and some observers were disposed to believe the market was going back to take another nap.

Possibility of More Buying Seen

Tuesday, however, at least one of the considerations which had helped to produce the higher prices took on additional importance. This was the possibility that labor disturbances, which already had begun to cripple crude production, would extend to refinery operations. Announcement by workmen representatives that a "production holiday" would go into effect May 10 in several refineries in the Chicago district if demands of employes were not granted was looked upon as likely to give fresh impetus to the buying movement, though no clear symptoms of a further upswing were immediately apparent.

Good motoring weather and proximity of the season of heaviest gasoline consumption added to the buying interest. Construed as a favorable development for refining and marketing interests were reports that the administration in Washington is strong in its support of the bill introduced by U. S. Senator Thomas designed to place crude oil production directly under supervision of the Federal Government. The belief prevails generally that with the production of crude held rigidly to requirements the worst of the troubles faced by refiners and marketers would disappear. The Thomas bill is in the hands of the Interstate Commerce Committee of the Senate.

Notwithstanding market activity and evidences of fairly substantial buying, it is declared by shrewd observers that the actual volume of gasoline that changed hands during the recent upturn was less than indicated by surface signs. Jobber buying is said to have been inconsequential. Most of the jobbers seem to have settled into a state of skepticism regarding the significance of market seesaws. Much of the gasoline bought is reported to have gone to major companies, which viewed it as better business to buy at current levels than to dip into their own storage. By adopting this practice they are able to hold their stocks for the higher prices which are expected to prevail at the peak of the consuming season a few weeks later. Although the most active trading was in the low octane material, the other grades shared in the improved prices.

Natural Gasoline Stronger

Largely in sympathy with the refinery gasoline the naturals acquired greater strength during the last week. Substantial refinery buying was reported. Although refiners need little of the natural gasoline at this juncture in view of the fact that they are building motor fuel for warm weather consumption, when volatility is not so important as in winter, nevertheless those with storage facilities bought moderately simply because the material was available at bargain prices.

The market was firm and sensitive, and while nobody looked for especially active trading, it was regarded as more probable that it would gain somewhat in strength than that it would weaken. The better tone was revealed in a slight stiffening of prices.

Kerosene was easier, but quotations held.

The lubricants continued to present a bright spot in the market picture. The neutrals, which have worked their way to an unexpectedly important place among petroleum products in the last few weeks, showed no signs of relaxing their hold, but on the contrary seemed likely to be commanding still higher prices soon.

Bright stocks moved into higher ground under the impulse of a stronger demand which added three-quarters of a cent to quotations throughout the list. Steam refined stocks shared in the heavier demand and prices were higher.

Wax exhibited a slightly better tone.

The 24-26 grade of fuel was scarce, with prices steady. Distillates were easy.

Refined Oil Market Barometer

Strength derived from forces of somewhat obscure origin characterized the refinery gasoline market in the Mid-Continent area, with the naturals sharing in the stronger demand but not to the same extent. Neither the East nor West Coast participated in the trading activity. Jobber buying indifferent, owing apparently to lack of faith in the character of the market. No signs of abatement of the strength recently acquired by lubricants. Improved export business predicted.

Mid-Continent.—Strong market in refinery gasoline, with prices up. Naturals firm. Lubricants strong.

East Coast.—Weak spots noticeable, with disposition to give price concessions. Jobbers displaying little interest.

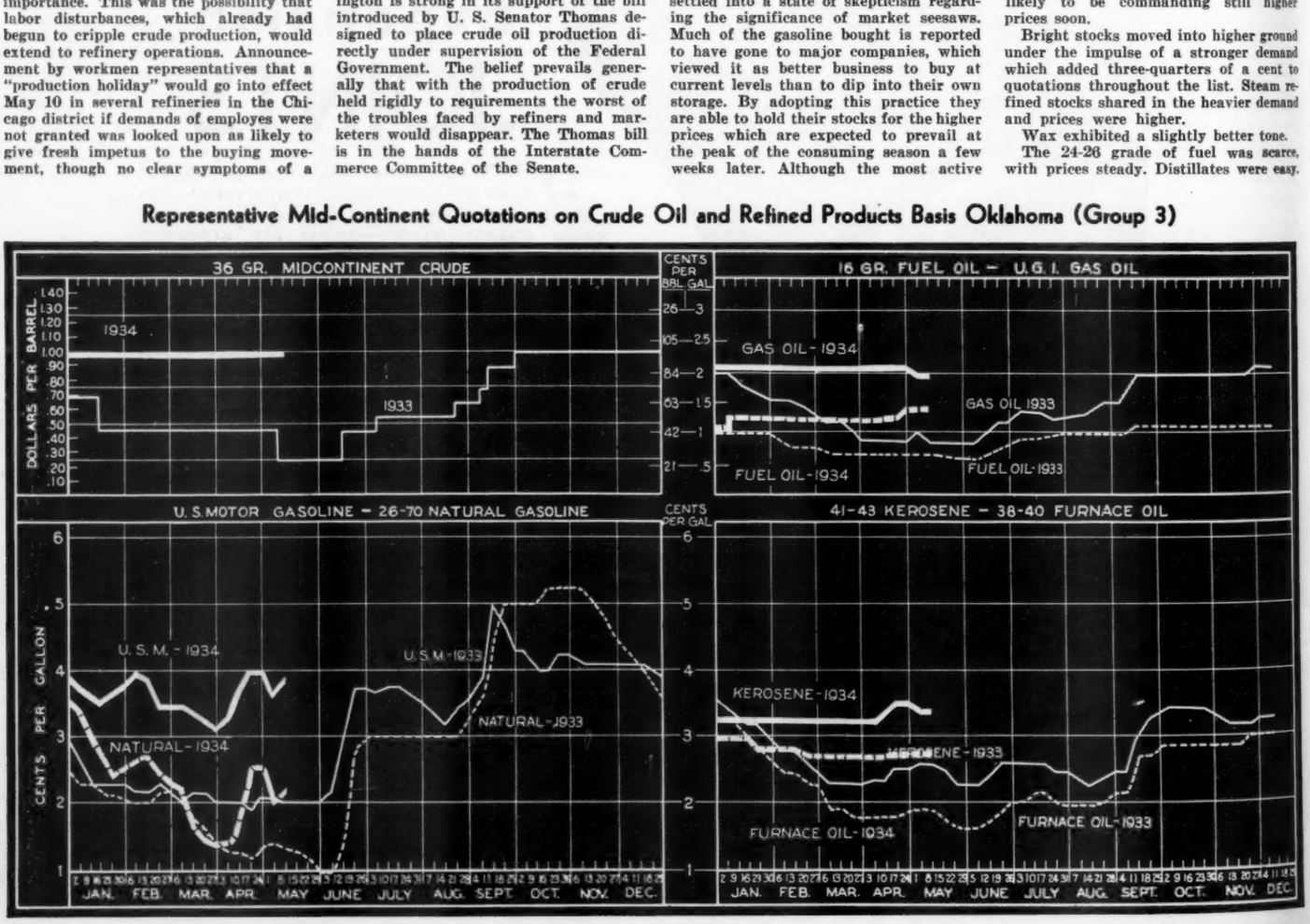
Gulf Coast.—Fuel oil and kerosene firm, but buying of all products slow. No price changes.

Pennsylvania.—Rapid rise in neutrals and bright stocks causing uneasiness among marketers competing with western products. Straightrun gasoline up.

California.—Featureless market, with no price changes.

Chicago.—Spot gasoline strong and offers scarce; buying better. Kerosene quiet. Fuels and gas oils strong. Naphthas firm.

Representative Mid-Continent Quotations on Crude Oil and Refined Products Basis Oklahoma (Group 3)



Temporary Weakness in Atlantic Coast Markets; Jobbers Hesitant About Filling Requirements

By C. O. WILLSON
New York Bureau, The Oil and Gas Journal

NEW YORK, May 7.—Developments in refinery markets of this area over the past week did not point to the higher prices which have been predicted for May by many buyers as well as sellers. While the weakness had its temporary aspects, a few sellers in order to secure immediate business gave price concessions and the market in several products had a sloppy appearance.

Jobbers were not rushing into the market to cover their May and later requirements despite predictions in some circles that prices on tank car material will be from one-half to 1 cent per gallon higher before the end of the month. Most of the larger sellers were maintaining their prices on all grades and in several instances were not willing to take business for delivery over May at today's prices apparently sharing the optimistic view that quotations will be advanced later in the month. At the same time those sellers who had gasoline to move promptly found little business available outside their regular trade channels.

Effective today (May 7) the Standard Oil Co. of New York, Inc., advanced gasoline tank wagon and service station prices 1 cent in Kings, Queens, and Nassau Counties, and one-half cent in Suffolk County. This advance presumably ends the price war in that territory which resulted in the 1-cent reduction in gasolines effective April 20. Gasoline prices are again the same throughout the New York metropolitan area. For the regular grade gasoline these prices are now 14.5 cents tank wagon and 15.5 cents service station, including 3 cents state and 1 cent Federal tax.

Those in charge of tank wagon and retail markets are constantly faced with price cutting at scattered points. Usually the price returns to normal levels after a few days but there are several important consuming points where prices are subnormal. It is difficult to explain these retail cuts if it is assumed that the Federal and state taxes are being paid. Taking the prevailing tank car prices at coastal prices and adding freight, the delivered prices are not low enough in relation to tank wagon and service station prices to encourage price cutting. In fact, jobbers and dealers at many points are asking for wider margins stating they cannot break even in their present operations.

Export Gasoline More Active

In the export end, sellers were encouraged by the first sign of activity in spot sales in several weeks. The small quantity of new business available in European markets has been going to Rumanian sellers who were reported to be quoting from one-fourth to one-half cent per gallon under the Gulf Coast market. American sellers were preparing to meet this competition when the Rumanian quotations advanced. Two cargoes were placed with American sellers last week the total of the two shipments being approximately 140,000 tons. The reported price for the 64-66 375 endpoint material at the Gulf Coast was 4½ to 4⅝ cents. The cargoes are for June delivery. While these prices are below the prevailing market at the Gulf Coast during April, which was 4¾ to 5 cents, sellers were inclined to believe that more business would be available at higher levels. It is pointed out that a steady foreign business is desirable over the next few months to remove material which otherwise will have to be absorbed by the domestic markets. It is known in this connection that meetings attended by important factors in European markets have recently been held for the purpose of bringing about a healthier market situation with emphasis placed on the Rumanian and French situation. The latter has greatly reduced its imports due to the expansion of its own refining facilities and this has tended to disrupt the normal business of Rumanian units and other companies which depend on European markets to absorb all of their refinery output.

Kerosene and Distillate

Kerosene and distillate prices were unsettled in the local market over the past week. Domestic kerosene is freely available at a tank car price of 5¼ cents in the New York area with indications that this price has been shaded in a few sales. The major refiners are endeavoring to maintain a price of 5½ cents at New York and at other coastal points, including Philadelphia, the usual quoted price is 6 cents. It is said that lack of activity in the kerosene export markets at the Gulf Coast has increased shipments to East Coast points and this fact, coupled with a seasonal decline in demand applying to this area, accounts for the price weakness.

It is believed that this situation is temporary. It is certain that the yearly contracts will not be renewed on the basis of the season just closing so this resale material will cease to be a factor after June 1. It is known that at least two large refiners in this territory are in the market for large quantities of furnace oil and gas oil. These companies have been accustomed to supplement their own refinery output with supplies from the Gulf Coast on yearly contracts. The Gulf Coast market is much tighter than it was a year ago and spot prices are higher and no large quantities available on long time contracts. Some observers are confident that more material will be available during the summer months. While they feel that the statistical situation is in much better shape that it was a year ago they point out that Gulf Coast refiners and terminal operators buying material from inland refiners, have to look to the eastern states or market outlets. As to prices, much will depend on the action during the next few months in regard to the curtailment of refinery operations. Continued heavy runs in the face of a weak gasoline market will make larger quantities of the heavier oils available and could weaken a market which has been outstandingly strong since last fall.

There has been some shifting from heavy oil to coal in this territory during the past few months applying to industries, public utilities and marine consumers.

At these levels, the fuel oil was substantially cheaper than coal. These buyers purchase on a price basis only and are not interested in the fact that the use of fuel oil at their plants has many advantages aside from price over coal including cleanliness, avoidance of smoke nuisance and less storage space. Oil companies expected to lose these customers with a return to a more normal price for heavy oils which are now quoted at $1.30 for Bunker C. It is pointed out, however, that a continued advance in price will mean additional losses coming from consumers who have used oil for several years. This is particularly important in the case of contract buyers who are still buying their heavy fuels under $1 per barrel with long-time agreements entered into in 1932 and early 1933. Many of these contracts will expire during 1934.

Lubricants

Paraffin base neutrals, steam refined stocks and bright stocks continue very strong in this market. Several refiners have no spot material to offer and have advanced their prices until they are no longer a factor in current sales. Brokers who handle oils and stocks from the inland Pennsylvania groups of refiners are usually faced with quotations which are higher including freight costs than the quotations of local refiners. The low on low cold test Pennsylvania grade bright stock in bulk is now 30 cents and a 200 grade neutral No. 3 will cost at least that much. The latter product is hard to find at any price.

American Petroleum Institute Weekly Refinery Statistics

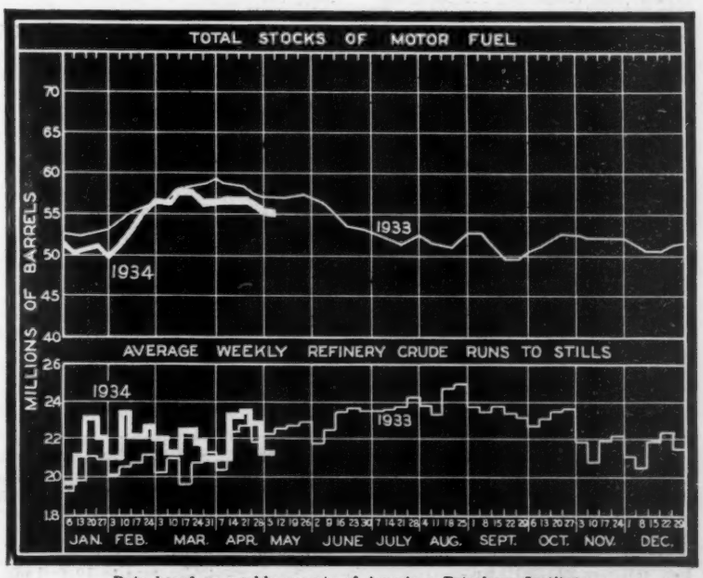
Figures below reported for week by American Petroleum Institute. (1) Per cent refinery capacity represented. (2) Daily average crude runs to stills. (3) Total motor fuel stocks. (4) Gas oil and fuel oil stocks. All figures in 42-gallon barrels.

Week Ending May 5, 1934, Compared to Week Ago

	Week ending April 28, 1934				Week ending April 28, 1934			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
East Coast	100.0	440,000	17,433,000	6,900,000	100.0	478,000	17,072,000	6,902,000
Appalachian ...	93.3	90,000	1,789,000	832,000	93.3	98,000	1,977,000	758,000
Ind., Ill., Ky. ..	94.6	293,000	9,358,000	2,747,000	94.6	286,000	9,501,000	2,674,000
Okla., Kans., Mo.	83.7	195,000	5,598,000	2,912,000	83.7	229,000	5,496,000	2,890,000
Inland Texas ...	47.6	82,000	1,357,000	1,757,000	47.6	87,000	1,429,000	1,724,000
Texas Gulf	97.5	487,000	4,709,000	4,838,000	97.4	493,000	4,698,000	4,587,000
La. Gulf	96.4	108,000	1,299,000	992,000	96.4	107,000	1,522,000	946,000
N. La. and Ark..	83.7	45,000	267,000	503,000	83.7	42,000	274,000	487,000
Rocky Mtn.	66 7	21,000	1,415,000	711,000	66.7	32,000	1,486,000	690,000
California	96.9	411,000	12,464,000	80,884,000	99.9	433,000	12,655,000	82,108,000
Total U. S. ...	89.7	2,172,000	55,689,000	103,076,000	89.7	2,285,000	56,011,000	103,766,000

Week Ending May 5, 1934, Compared to Year Ago

	Week ending April 28, 1934				Week ending May 6, 1933			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
East Coast	100.0	440,000	17,433,000	6,900,000	99.1	477,000	16,332,000	6,822,000
Appalachian ...	93.3	90,000	1,789,000	832,000	95.0	83,000	2,109,000	852,000
Ind., Ill., Ky. ..	94.6	293,000	9,358,000	2,747,000	97.5	301,000	8,440,000	3,637,000
Okla., Kans., Mo.	83.7	195,000	5,598,000	2,912,000	84.9	228,000	4,947,000	3,095,000
Inland Texas ...	47.6	82,000	1,357,000	1,757,000	56.4	69,000	1,632,000	2,092,000
Texas Gulf	97.5	487,000	4,709,000	4,838,000	97.7	463,000	5,900,000	5,982,000
La. Gulf	96.4	108,000	1,299,000	992,000	97.3	98,000	1,585,000	1,850,000
N. La. and Ark..	83.7	45,000	267,000	503,000	88.5	37,000	312,000	567,000
Rocky Mtn.	66.7	21,000	1,415,000	711,000	90.8	32,000	1,226,000	624,000
California	96.9	411,000	12,464,000	80,884,000	94.6	450,000	14,458,000	98,232,000
Total U. S. ...	89.7	2,172,000	55,689,000	103,076,000	91 6	2,238,000	56,941,000	123,153,000



Data based on weekly reports of American Petroleum Institute

REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement except as otherwise noted

The following quotations are exclusive of the Federal excise taxes of 1 cent a gallon on gasoline and 4 cents on lubricating oils.

Refinery Gasolines

	May 8		May 1	
OKLAHOMA (Group 3)—				
U. S. Motor grades:				
Below 60 octane	.037/8	.041/8	.035/8	.037/8
60-64.9 octane	.041/2	.043/4	.041/4	.041/2
65-70 octane	.043/4	.05	.041/2	.041/4
60-62 400 grades:				
Below 60 octane	.04	.041/4	.033/4	.04
60-64.9 octane	.045/8	.047/8	.041/2	.043/4
65-70 octane	.05	.051/8	.043/4	.05
64-66 375	.041/8	.043/8	.04	.041/4
68-70 360	.041/4	.041/2	.041/8	.043/8
NORTH TEXAS—				
U. S. Motor grades:				
Below 60 octane	.037/8	.04	.035/8	.037/8
60-64.9 octane	.041/2	.043/4	.041/4	.041/2
65-70 octane	.05	.051/8	.043/4	.045/8
60-62 400	.04	.041/4	.033/8	.037/8
64-66 375	.041/8	.043/8	.04	.041/4
68-70 360	.041/4	.041/2	.041/8	.043/8
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
U. S. Motor grades:				
Below 60 octane	.043/8	.041/2	.04	.041/8
60-64.9 octane	.051/8	.051/4	.043/4	.05
65-70 octane	.055/8	.051/2	.05	.051/4
60-62 400	.043/8	.041/2	.041/8	.043/8
ARKANSAS (Ark., N. La. & Miss. del.)—				
U. S. Motor grades:				
Below 60 octane	.043/8	.041/2	.041/8	
60-64.9 octane	.051/8	.051/4	.043/4	.05
65-70 octane	.055/8	.051/2	.05	.051/4
CHICAGO (based on Oklahoma Group 3)—				
U. S. Motor grades:				
Below 60 octane	.04	.041/2	.037/8	.04
60-64.9 octane	.045/8	.043/4	.041/2	.045/8
65-70 octane	.047/8	.05	.043/4	.047/8
60-62 400	.04	.041/4	.037/8	.041/8
64-66 375	.041/8	.043/8	.041/4	.043/8
68-70 360	.043/8	.041/2	.043/8	.045/8
Aviation fighting grade	.05	.051/4	.05	.051/4
PENNSYLVANIA (inland refineries)—				
58-60 U. S. Motor:				
Below 60 octane	.055/8	.055/8	.05	.051/4
60-64.9 octane	.061/8	.061/4	.06	.061/4
65-70 octane	.065/8	.063/4	.061/2	.063/4
68-70 350	.07	.071/2	.061/4	.061/2
CALIFORNIA (domestic movement)—				
54-58 U. S. Motor	.041/4	.051/4	.041/4	.051/4
58-60 400	.05	.06	.05	.06
EAST COAST—				
U. S. Motor, below 60 octane:				
New York	.051/2	.053/4	.051/2	.053/4
Baltimore	.051/2	.053/4	.051/2	.053/4
U. S. Motor, 60-64 octane:				
New York (Bayonne)	.053/4	.06	.053/4	.06
Philadelphia	.06	.061/4	.06	.061/4
Boston	.06	.061/4	.06	.061/4
Baltimore	.053/4		.053/4	
Charleston, S. C.	.053/4		.053/4	
U. S. Motor, 65 and above:				
New York (Bayonne)	.06	.061/4	.06	.061/4
Philadelphia	.061/4	.061/2	.061/4	.061/2
Boston	.061/4	.061/2	.061/4	.061/2
Baltimore	.06	.061/4	.06	.061/4
Charleston, S. C.	.06	.061/4	.06	.061/4
GULF COAST (domestic)—				
U. S. Motor:				
Below 60 octane	.051/2	.053/4	.051/2	.053/4
60-64.9 octane	.053/4	.06	.053/4	.06
65 octane and higher	.06	.061/4	.06	.061/4

Naphthas

	May 8		May 1	
PENNSYLVANIA (inland refineries)—				
50-54 430-450 (blending)	.047/8		.047/8	
CHICAGO (based on Oklahoma Group 3)—				
50-52 450 (blending)	.041/4	.041/2	.04	.041/2
Cleaners' naphtha, 56-58 gr., 200 i.b.p.-330 e.p.	.063/4	.07	.063/4	.07
Lacquer diluent, 180 i.b.p.-250 e.p.	.073/4	.08	.073/4	.08
Lacquer diluent, 140 i.b.p.-200 e.p.	.083/4	.09	.083/4	.09
Rubber solvent, 68-70 gr., 100 i.b.p.-330 e.p.	.063/4	.07	.063/4	.07
Stoddard solvent, 300 i.b.p.-410 e.p., over 83° flash	.061/4	.065/8	.061/4	.063/4
Pet. thinner, 290-300 i.b.p.-415 e.p., over 83° flash	.061/4	.061/2	.061/4	.061/2
V.M.&P. naphtha, 56-58 gr., 190-200 i.b.p.-330 e.p.	.063/4	.07	.063/4	.07
Petroleum spirits	.053/4	.06	.055/8	.06

Natural Gasolines

	May 8		May 1	
OKLAHOMA (Group 3)—				
Grade 26-70	.02	.021/8	.02	
Grade 18-55	.025/8	.027/8	.021/2	.025/8
Low vapor pressure grades:				
15 lb. v.p. (max.)	.027/8	.03	.027/8	.03
11 lb. v.p. (max.)	.033/4	.04	.033/4	.04
NORTH TEXAS—				
Grade 26-70	.013/4	.017/8	.013/4	
Grade 18-55	.025/8	.025/8	.023/8	.021/2
Low vapor pressure grades:				
15 lb. v.p. (max.)	.023/4	.027/8	.023/4	.03
11 lb. v.p. (max.)	.031/2	.033/4	.031/2	.033/4
NORTH LOUISIANA—				
Grade 26-70	.023/8	.021/2	.023/8	
CALIFORNIA—				
75-78 375	.043/4	.051/4	.043/4	.051/4

Kerosenes

(All kerosenes water white)

	May 8		May 1	
OKLAHOMA (Group 3)—				
41-43	.031/2	.035/8	.031/2	.035/8
42-44	.033/4	.037/8	.033/4	.037/8
NORTH TEXAS—				
40-41	.033/8	.031/2	.033/8	.031/2
41-43	.031/2	.035/8	.031/2	.035/8
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
41-43	.035/8		.035/8	
ARKANSAS (Ark., N. La. & Miss. del.)—				
41-43	.035/8		.035/8	
PENNSYLVANIA (inland refineries)—				
45	.043/8	.045/8	.043/8	.045/8
46	.041/2	.047/8	.041/2	.047/8
47	.047/8	.051/8	.047/8	.051/2
CHICAGO (based on Oklahoma Group 3)—				
41-43	.033/8	.037/8	.033/8	.037/8
42-44	.037/8	.04	.037/8	.04
CALIFORNIA (Pacific Coast consumption)—				
38-40 high burning test	.041/2	.05	.041/2	.05
NEW YORK (Bayonne, N. J.)—				
41-43	.051/4	.051/2	.051/4	.051/2
GULF COAST (domestic)—				
41-43	.043/4	.05	.043/4	.05

Petroleum Coke

Prices per ton f.o.b. refineries in Chicago area. (Refineries will absorb freight to 80 cents a ton)

	May 8		May 1	
Breeze (screenings)	5.00		5.00	
Pile run	5.00		5.00	
Direct from still	6.00		6.00	
Lump and egg	7.00	8.00	7.00	8.00

Furnace Oils and Tractor Fuels

(Zero cold test under 190° flash and good odor)

	May 8		May 1	
OKLAHOMA (Group 3)—				
32-36 straw	.025/8	.023/4	.025/8	.023/4
36-38 straw	.025/8	.023/4	.025/8	.023/4
38-40 straw	.025/8	.027/8	.023/4	.027/8
39-41 prime white	.027/8	.03	.027/8	.03
NORTH TEXAS—				
38-40 straw	.023/4	.03	.023/4	.03
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
36-40 furnace oil	.03		.03	
ARKANSAS (Ark., N. La. & Miss. del.)—				
32-36 furnace oil	.023/4	.027/8	.023/4	.027/8
CHICAGO (based on Oklahoma Group 3)—				
32-36 straw	.023/4	.03	.023/4	.03
38-40 straw	.027/8	.03	.027/8	.03
38-40 prime white	.031/8	.031/4	.031/8	.031/4
PENNSYLVANIA (inland refineries)—				
40-41 prime white	.043/8		.043/8	.041/2
NEW YORK (Bayonne, N. J.)—				
36-40 (No. 1 grade)	.051/4	.051/2	.051/4	.051/2
32-36 (No. 2 grade)	.041/2	.043/4	.041/2	.043/4
21 industrial (No. 4 grade)	.04	.041/4	.04	.041/4

Gas Oil, Diesel Oil and Fuel Oil

(Gas oil per gallon; Diesel and fuel oils per barrel)

	May 8		May 1	
OKLAHOMA (Group 3)—				
32-36 gas oil cracking stock	.021/8	.023/8	.021/8	.023/8
U.G.I. gas oil	.02	.021/4	.02	.021/4
32-36, zero to 15 gas oil	.021/2	.025/8	.021/2	.025/8
28-30, No. 3 burner oil	.95	1.00	.95	1.00
28-30, zero to 10 fuel oil	.90	.95	.90	.95
26-30, zero to 10 fuel oil	.85	.95	.85	.95
24-26 fuel oil	.70	.75	.70	.75
20-22 fuel oil	.65	.70	.65	.70
Below 16 fuel oil	.60	.65	.60	.65
NORTH TEXAS—				
32-36 gas oil, industrial	.02		.02	
22-26 fuel oil	.621/2	.671/2	.621/2	.671/2
Below 20 fuel oil	.521/2	.60	.521/2	.60
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
32-36 gas oil, zero	.023/4	.03	.023/4	.03
14-16 fuel oil	.70	.75	.70	.75
ARKANSAS (Ark., N. La. & Miss. del.)—				
30-32 gas oil, zero	.023/4	.03	.023/4	.03
32-36 gas oil	.021/2	.023/4	.021/2	.023/4
14-16 fuel oil	.70	.75	.70	.75
CHICAGO (based on Oklahoma Group 3)—				
32-36 gas oil, industrial	.021/8	.021/4	.021/8	.021/4
28-30 zero to 10, fuel oil	.921/2	1.00	.95	1.00
26-28 zero to 10, fuel oil	.85	.90	.85	.90
22-26 zero to 10, fuel oil	.75	.80	.75	.80
18-22 zero to 10, fuel oil	.621/2	.671/2	.621/2	.671/2
Below 18 fuel oil	.521/2	.571/2	.521/2	.571/2

Note: Fuel oils of more than 40 cold test generally 5 to 15 cents per barrel less in all these areas.

PENNSYLVANIA (inland refineries)—				
36-40	.037/8	.04	.037/8	.04
CALIFORNIA—				
30-34 gas oil per bbl.	1.00	1.10	1.00	1.10
27 plus Diesel	1.00	1.10	1.00	1.10
15-19 bunker (at tidewater)	.60	.70	.60	.70
15-19 (cargo lots)	.55	.60	.55	.60
15-19 (tank cars)	.50	.65	.50	.65
GULF COAST—				
28-30 gas oil	.031/2	.033/4	.031/2	.033/4
28-30 Diesel (bunkers)	1.80		1.80	
Bunker C (bulk cargoes)	.95	1.00	.95	1.00
Bunker C (bunkers)	1.15		1.15	
NEW YORK (Bayonne, N. J.)—				
28 plus, gas oil	.041/4	.041/2	.041/4	.041/2
28-30 Diesel (lighterage 6½ cents per bbl.)	1.95		1.95	
28-30 Diesel (tank cars)	.041/2		.041/2	
*Bunker C (to ocean-going ships in N. Y. harbor)	1.30		1.30	

*Lighterage charge 5 cents per barrel additional.

Neutral Oils

(Vis. at 100° F. except Pennsylvania, and color N.P.A.)

	May 8		May 1	
OKLAHOMA (Group 3)—				
Zero to 10 Cold Test:				
150-3	.083/4		.083/4	
180-3	.10		.10	
180-4	.091/2		.091/2	
200-3	.101/2		.101/2	
200-4	.10		.10	
240-3	.121/2		.121/2	
240-4	.12		.12	
280-3	.131/2		.131/2	
280-4	.123/4		.123/4	
300-31/2	.14		.14	
400-4	.16		.16	
100-2 paraffin oil	.061/2		.061/2	
15-30 Cold Test:				
200-3	.091/2		.091/2	
200-4	.09		.09	
240-3	.111/2		.111/2	
240-4	.11		.11	
280-3	.121/2		.121/2	
280-4	.113/4		.113/4	
GULF COAST—				
Pale Oils:				
200-3	.071/2		.071/2	
300-3	.08	.081/4	.08	.083/4
500-31/2	.09	.091/4	.09	.091/4
750-31/2	.091/2	.093/4	.091/2	.093/4
1,200-31/2	.10	.101/4	.10	.101/4
2,000-4	.101/4	.101/2	.101/4	.101/2
Red Oils:				
200-5-6	.061/2		.061/2	
300-5-6	.07	.071/4	.07	.073/4
500-5-6	.08	.083/4	.08	.083/4
750	.081/2	.083/4	.081/2	.083/4
1,200-5-6	.09	.091/4	.09	.093/4
2,000-6½ plus	.091/4	.091/2	.091/4	.091/2
CALIFORNIA—				
Pale Oils:				
100-2½-3	.23	.25	.23	.25
200-2½-3	.23	.25	.23	.25
300-3-3½	.23	.25	.23	.25
350-3-4	.23	.25	.23	.25
400-3-4	.23	.25	.23	.25
450-3-4	.23	.25	.23	.25
550-3-4	.23	.25	.23	.25
600-3-4	.23	.25	.23	.25
Red Oils:				
200-4-5	.23	.25	.23	.25
300-5-6	.23	.25	.23	.25
350-5-6	.23	.25	.23	.25

400-5-6	.23	.25	.23	.25
450-5-6	.23	.25	.23	.25
500-5-6	.23	.25	.23	.25
600-5-6½	.23	.25	.23	.25
700-6½ plus	.23	.25	.23	.25
750-6½ plus	.23	.25	.23	.25
900-6½ plus	.23	.25	.23	.25
PENNSYLVANIA—				
150 vis. at 70° F., 3 color; 400-405 flash:				
Zero pour test	.25½	.26	.25	.25½
10 pour test	.24½	.25	.24	.24½
15 pour test	.24	.24½	.23½	.24
25 pour test	.23	.23½	.22½	.23
180 vis. at 70° F., 3 color:				
25 pour test	.27	.27½	.26½	.27
200 vis. at 70° F., 3 color:				
Zero pour test	.32	.33½	.31½	.33
10 pour test	.30½	.32	.30	.31½
15 pour test	.30	.30½	.29½	.30
25 pour test	.29½	.30	.29	.29½

Bright and Steam Refined Stocks

OKLAHOMA (Group 3)—	May 8		May 1	
Bright Stocks:				
190-200 D	.27¼		.26½	
150-160 D, 0-10	.24½		.23¾	
150-160 D, 10-25	.24		.23¼	
150-160 25-40	.23½		.22¾	
150-160 E	.23½		.22¾	
Steam refined:				
630 light green (treated)	.15½		.15	
600 light green (untreated)	.07½	.09	.07	.09
600 dark green (untreated)	.05½	.08	.05	.07
PENNSYLVANIA—				
Steam refined:				
600	.19½	.20	.19	.19½
650	.22	.22½	.21½	.22
600 Pennsylvania flash	.23	.23½	.22½	.23
630 flash	.27½	.28	.27	.27½
600 Warren E filtered	.22½	.23	.22	.22½
Bright Stocks (Pennsylvania grade, No. 8 color, 145-50 at 210; 540-550 flash):				
10 pour test	.30	.30½	.30	.30½
15 pour test	.29½	.30	.29½	.30
20 pour test	.29	.29½	.29	.29½
25 pour test	.28½	.29	.28½	.29

Wax and Petrolatum

(Prices per pound)

OKLAHOMA (Group 3)—	May 8		May 1	
124-126 white crude scale	.03⅝	.03¾	.03⅝	.03¾
PENNSYLVANIA—				
122-124	.0380		.0380	
124-126	.0385		.0385	
NEW YORK HARBOR—				
Wax (a.m.p.) in bags fully refined:				
120-122	.0420	.0430	.0420	.0430
123-125	.0435	.0460	.0435	.0460
125-127	.0445	.0470	.0445	.0470
128-130	.0480	.0495	.0480	.0495
130-132	.05	.0510	.05	.0510
133-135	.0545	.0570	.0545	.0570
135-137	.0570	.0595	.0570	.0595
124-126 crude scale	.03½	.03¾	.03½	.03¾
Petrolatum in barrels in carload lots:				
Dark green	.01⅞	.02	.01⅞	.02
Amber	.02⅞	.03	.02⅞	.03
Extra amber	.03⅛	.03¼	.03⅛	.03¼
Lily white	.06¾	.06⅞	.06¾	.06⅞
Snow white	.07¾	.07⅞	.07¾	.07⅞
Cream	.05⅝	.05¾	.05⅝	.05¾
CHICAGO (f.o.b. switching district)*—				
122-124 wax	.0465	.0475	.0465	.0475
125-127 wax	.0490	.0500	.0490	.0500
127-129 wax	.0505	.0515	.0505	.0515
130-132 wax	.0565	.0575	.0565	.0575
132-134 wax	.0590	.0600	.0590	.0600

*Cents per pound on carlot orders in burlap bags of 225 lbs. approx. Add 3° F. a.m.p.

Export Prices

GASOLINE

GULF COAST—	May 8	May 1
U. S. Motor	.04¼	.04¼
60-62 400	.04⅜	.04⅜ .04½
61-63 390	.04⅜ .04½	.04½ .04⅝
64-66 375	.04⅝ .04¾	.04¾ .04⅞
LOS ANGELES, CALIF.—		
U. S. Motor grades:		
53-55 octane	.04 .04¼	.04 .04¼
55-65 octane	.04¼ .04½	.04¼ .04½
65-67 octane	.04½ .04¾	.04½ .04¾
67-69 octane	.04¾ .05	.04¾ .05
Above 69 octane	.05 .05¼	.05 .05¼
58-60 400 endpoint	.04¾ .05½	.04¾ .05½

KEROSENE

GULF COAST—				
41-43 prime white	.04¼ .04¾		.04¼ .04¾	
41-43 water white	.04⅜ .04½		.04⅜ .04½	
44 water white	.04½ .04⅝		.04½ .04⅝	
LOS ANGELES, CALIF.—				
41-43 water white	.04¼ .04¾		.04¼ .04¾	

LUBRICANTS

NEW YORK (f.a.s. in bbls.)—				
Cylinder Stocks:				
600 Warren E	.28	.29	.28	.29
600 S.R. unfiltered	.26	.26½	.26	.26½
650 S.R. unfiltered	.28	.28½	.28	.28½
600 flash S.R.	.29	.29½	.29	.29½
630 flash S.R.	.33	.33½	.33	.33½
Bright Stocks:				
8 color	.35	.37	.35	.37
6½ plus color, in dilution	.34	.35	.34	.35

NEUTRAL OILS

200-3 color	.36	.37	.35½	.36½
150-3 color	.31	.32	.30½	.31½

PARAFFIN WAX (Fully Refined)

NEW YORK (prices per pound)—				
120-122 a.m.p.	.0405	.04¼	.0405	.04¼
123-125 a.m.p.	.0430	.0455	.0430	.0455
125-127 a.m.p.	.0440	.0465	.0440	.0465
128-130 a.m.p.	.04¾	.0490	.04¾	.0490
130-132 a.m.p.	.0495	.0505	.0495	.0505
133-135 a.m.p.	.0540	.0565	.0540	.0565
135-137 a.m.p.	.0565	.0590	.0565	.0590

Crude Oil Gravity Table

Degrees gravity—	1 Oklahoma and Kansas	2 North Texas, Central Texas and East Central Texas	3 North Louisiana and Arkansas	4 Gray County, Texas	5 Carson, Hutchinson, and Moore Counties, Texas	6 Conroe, Texas	7 Salt Creek, Wyo.	8 Gulf Coast, Texas, and Louisiana	9 Gulf Coast, Texas, and Louisiana	10 Cotton Valley, Louisiana
Below 20	....	....	....	....	....	....	....	$.82	$.82	....
20-20.9	....	....	....	....	....	....	....	.84	.84	....
21-21.9	....	....	....	....	....	....	....	.86	.86	....
22-22.9	....	....	....	....	....	....	....	.88	.88	....
23-23.9	....	....	....	....	....	....	....	.90	.90	....
24-24.9	....	....	....	....	....	....	....	.92	.92	....
Below 25	*$.76	....	....	....	....	....	....	....	....	$.70
25-25.9	*.78	....	....	....	....	....	....	.94	.94	.72
26-26.9	*.80	....	....	....	....	....	....	.96	.96	.74
27-27.9	*.82	....	....	....	....	....	....	.98	.98	.76
28-28.9	*.84	....	....	....	....	....	....	1.00	1.00	.78
Below 29	.84	$.79	$.79	....	....	....	$.84	....	....	....
29-29.9	.86	.81	.81	....	....	....	.86	1.02	1.02	.80
30-30.9	.88	.83	.83	....	....	....	.88	1.04	1.04	.82
31-31.9	.90	.85	.85	....	....	....	.90	1.06	1.05	.84
32-32.9	.92	.87	.87	....	....	....	.92	1.08	1.06	.86
33-33.9	.94	.89	.89	....	....	....	.94	1.10	1.07	.88
34-34.9	.96	.91	.91	....	....	....	.96	1.12	1.08	.90
Below 35	....	....	....	$.79	$.69	....	....	....	....	....
35-35.9	.98	.93	.93	.81	.71	$1.09	.98	1.12	1.09	.92
36-36.9	1.00	.95	.95	.83	.73	1.11	1.00	1.12	1.10	.94
37-37.9	1.02	.97	.97	.85	.75	1.13	1.02	1.12	1.11	.96
38-38.9	1.04	.99	.99	.87	.77	1.15	1.04	1.12	1.12	.98
39-39.9	1.06	1.01	1.01	.89	.79	1.17	1.06	1.12	1.13	1.00
40 and over	1.08	1.03	1.03	.91	.81	1.19	1.08	1.13	1.14	1.02

*The following companies purchasing crude oil in Kansas or Oklahoma, or both, begin their price schedules: Below 25 degrees, 76 cents; 25-25.9 degrees, 78 cents, with 2 cents added for each degree upward to 40 and over at $1.08: Carter Oil Co., Magnolia Petroleum Co., Pure Oil Co., Rock Island Refining Co., Shell Petroleum Corp., Sinclair Prairie Oil Marketing Co., Skelly Oil Co., and Wilcox Oil & Gas Co. All others begin their schedule at below 31 degrees, 84 cents, excepting Phillex Oil Co., which begins with below 31 degrees at 81 cents.

Column 1—Effective September 29, Texas Co. in Oklahoma; Stanolind Crude Oil Purchasing Co. in Kansas and Oklahoma; Anderson & Prichard, Inc., in Oklahoma; Bell Oil & Gas Co. in Oklahoma; Carter Oil Co. in Oklahoma and Kansas; Deep Rock Oil Co. in Oklahoma; Derby Oil Co. in Kansas; Globe Refining Co. in Oklahoma; Golden Rule Refining Co. in Kansas; Gypsy Oil Co. in Oklahoma and Kansas; Kanotex Refining Co. in Kansas; Magnolia Petroleum Co. in Oklahoma; Mid-Continent Petroleum Corp. in Oklahoma; National Refining Co. in Kansas and Oklahoma; Shell Petroleum Corp. in Kansas and Oklahoma; Sinclair Prairie Oil Marketing Co. in Kansas and Oklahoma; Texas Co. in Oklahoma; Tide Water Oil Co. in Oklahoma; Vickers Refining Co. in Kansas; Continental Oil Co. in Kansas and Oklahoma; Empire Pipe Line Co. in Oklahoma and Kansas; Phillex Oil Co. in Kansas and Oklahoma; Pure Oil Co. in Oklahoma; Skelly Oil Co. in Kansas. Effective September 29, by White Eagle Oil Corp. in Kansas; on October 1 by Barnsdall Refineries, Inc., in Oklahoma.

Column 2—Effective September 29, by Texas Co., Stanolind Crude Oil Purchasing Co., Humble Oil & Refining Co., Sinclair Prairie Oil Marketing Co., Gulf Pipe Line Co., Magnolia Petroleum Co., Bell Oil & Gas Co., Continental Oil Co. Effective September 29, in the Van Pool, Van Zandt County, Pure Oil Co. posted below 29 degrees, 84 cents, with 2 cents added for each degree up to 40 and over at $1.08.

Column 3—Effective September 29, by Texas Co., Magnolia Petroleum Co., Gulf Refining Co. Effective December 22, Stanolind Oil & Gas Co. in Pine Island, Louisiana, and Marion County, Texas, posted below 29 degrees, 79 cents, with 2 cents added for each degree up to 40 and over at $1.03. Effective March 17, 1934, by Standard Oil Co. of Louisiana and Louisiana Oil Refining Co. Starting with below 25 degrees, 71 cents, adding 2 cents for each degree upward to 40 and over at $1.03.

Column 4—Effective September 29, by Texas Co., Humble Oil & Refining Co., Magnolia Petroleum Co., Sinclair Prairie Oil Marketing Co., and H. F. Wilcox Oil & Gas Co. On same day Phillex Oil Co. posted below 31 degrees, 71 cents, with 2 cents added for each degree up to 40 and over at 91 cents.

Column 5—Effective September 29, by Texas Co., Humble Oil & Refining Co., Gulf Pipe Line Co., Magnolia Petroleum Co., Wilcox Oil & Gas Co., Continental Oil Co. On same day, Phillex Oil Co. posted below 31 degrees, 61 cents, with 2 cents added for each degree upward to 40 and over at 81 cents.

Column 6—Effective September 29, by Humble Oil & Refining Co. and Tide Water Oil Co., and on September 30, by Texas Co. which on September 29 had posted a schedule of $1.07 to $1.12 with a 1-cent spread on each degree.

Column 7—Effective September 29 by Stanolind Oil & Gas Co.

Column 8—Effective September 29, by Humble Oil & Refining Co., Gulf Pipe Line Co., Shell Petroleum Corp., Pure Oil Co., Sinclair Prairie Oil Marketing Co. On October 2, Magnolia Petroleum Co. posted Lockport, Louisiana: 20-20.9 degrees, 94 cents, with 2 cents added for each degree upward to 34 and over at $1.12, and in Cameron Meadows and Iowa, Louisiana: Below 20 degrees, 72 cents with 1 cents added for each degree up to 34 and over at $1.02. These prices were 2 cents higher on each degree than Magnolia prices posted on September 29. Effective September 29, Shell Petroleum Corp. posted in Iowa, Louisiana, district: Below 20 degrees, 70 cents, with 2 cents added for each degree upward to 34 degrees and over at $1; and in Black Bayou and White Castle, Louisiana: Below 20 degrees, 80 cents, with 2 cents added for each degree upward to 34 degrees and over at $1.10.

Column 9—Effective September 30, Texas Co. (On September 29, Texas Co. had posted a schedule 2 cents lower on each degree, but changed it on September 30.)

Column 10—Effective September 29, by Louisiana Oil Refining Co.

(California Crude Oil Prices on Page 62)

Crude Oil Prices

Oklahoma, Kansas, North Central and East Central Texas

East Texas	$1.00
Stratman, Kans. (Sept. 29, 1933)	1.08
Corsicana (heavy) (June 17, 1933)*	.36
Other fields	(See gravity table)

Note—In East Texas, effective September 29, 1933, by Texas Co., Stanolind Crude Oil Purchasing Co., Humble Oil & Refining Co., Shell Petroleum Corp., Gulf Pipe Line Co., Tide Water Oil Co., Sinclair Prairie Oil Marketing Co., Magnolia Petroleum Co., Sun Oil Co., Panola Pipe Line Co., and Empire Oil & Refining Co.
*Magnolia Petroleum Co.

West Texas

Crane, Upton, Crockett, Howard, Glasscock, Mitchell (Sept. 29, 1933)	$ .70
Ector, Winkler and Pecos Counties and Lea County, New Mexico (Sept. 29, 1933)	.76
Pecos County, Yates shallow pool (Sept. 29, 1933)*	.65
Jones and Fisher Counties. See gravity table.	

Note—Effective September 29, 1933, by Humble Oil & Refining Co., Texas Co., Gulf Pipe Line Co., Shell Petroleum Corp., Magnolia Petroleum Co., and by Stanolind Oil & Gas Co. in Winkler County, Texas.
*Shell Petroleum Corp.

Gulf Coast

Grade A and Grade B specifications discontinued by leading buyers	(See gravity table)
Tomball (see note)*	$1.15
Livingston (Sept. 29, 1933)†	1.00
Cleveland (Jan. 11, 1934)	1.00
Greta (Sept. 29, 1933)	.85
Refugio, light	(See gravity table)
Refugio, heavy (Sept. 29, 1933)‡	.85
Markham and High Island	(See Gulf Coast gravity table)
Conroe	(See Conroe gravity table)

Note—Tomball, effective September 29, by Humble Oil & Refining Co., and October 2 by Magnolia Petroleum Co., and November 10 by Stanolind Oil & Gas Co.
*Greta posted by Texas Co. †Shell Petroleum Corp. ‡Refugio heavy, by Humble Oil & Refining Co. Cleveland (Liberty County), posted by Magnolia Petroleum Co.

South Central and Southwest Texas

(See note below table)

Darst Creek	$.87
Mirando	.80
Luling (Sept. 29, 1933)	.75
Pettus	1.05
Salt Flat	.87
Lytton Springs (Sept. 29, 1933)	.95
Duval County (Sept. 29, 1933)	.80
Saxet	.85

Note—Effective on September 29 by Humble Oil & Refining Co., in Darst Creek, Mirando, Pettus, Salt Flat and Saxet. Effective September 29 in Darst Creek by Gulf Pipe Line Co. and Texas Co. Effective October 2 by Magnolia Petroleum Co. Effective in Pettus and Salt Flat on September 29 by Humble Oil & Refining Co. and Gulf Pipe Line Co. Luling and Lytton Springs by Magnolia Petroleum Co. Duval County by Texas Co. Saxet, effective September 29, by Humble Oil & Refining Co. and Texas Co.

(Continued on Page 62)

TANK WAGON MARKETS

Quotations for gasoline and kerosene in United States, as furnished by the larger marketing concerns, include taxes

May 8, 1934

Taxes

The gasoline quotations given in the following tables include the 1 cent Federal tax, as well as state, county and city taxes. The gasoline quoted is the regular or standard grade. In most marketing areas a third grade and a premium grade are also available.

Discounts

Under the standard form of commercial consumer contract which went into effect March 1, 1934, save in California, Oregon, Washington, Arizona and Nevada, a discount of 1 cent a gallon off tank wagon, or 3 cents a gallon off retail prices, is permitted for purchases running between 3,000 and 10,000 gallons a month, and 2 cents a gallon off tank wagon, or 4 cents a gallon off retail prices, for purchases in lots of more than 10,000 gallons a month. The minimum delivery is 25 gallons.

Rocky Mountain District

CONTINENTAL OIL CO.

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero. tank wagon
Denver, Colo.	15.0	17.0	6.0	10.0
Pueblo	16.0	18.0	6.0	13.0
Grand Junction	21.5	23.5	6.0	15.0
Casper, Wyo.	18.0	20.0	5.0	11.5
Cheyenne	18.0	20.0	5.0	13.0
Butte, Mont.	21.0	23.0	5.0	17.5
Billings	21.0	23.0	6.0	16.5
Helena	22.5	24.5	6.0	17.5
Great Falls	21.5	23.5	6.0	17.5
Salt Lake, Utah	21.0	23.0	5.0	16.0
Boise, Idaho	22.0	24.0	6.0	18.0
Twin Falls	22.0	24.0	6.0	18.0
Albu'que, N. M.	19.5	21.5	*7.0	13.0

*One-cent city tax.

Effective March 1, 1934, discount to dealers with or without contract throughout Continental territory: Undivided dealer discount off service station price, 4 cents; divided dealer accounts, 3½ cents.

Standard Oil Co. (Indiana)

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero. tank wagon
Chicago	13.8	15.8	4.0	9.7
Decatur, Ill.	16.7	18.7	4.0	10.2
E. St. Louis	16.0	18.0	4.0	9.5
Joliet	16.7	18.7	4.0	10.2
Peoria	15.2	17.2	4.0	10.2
Quincy	16.6	18.6	4.0	10.9
Davenport Ia.	16.6	18.6	4.0	10.1
Des Moines	16.6	18.6	4.0	10.1
Mason City	15.8	17.6	4.0	9.3
Sioux City	16.2	18.0	4.0	9.7
Duluth, Minn.	17.2	19.2	4.0	10.4
Mankato	16.8	18.8	4.0	10.3
Minneapolis	15.4	17.4	4.0	10.4
LaCrosse, Wis.	18.3	20.3	4.8	10.8
Green Bay	17.7	19.7	5.0	10.2
Milwaukee	17.1	17.1	5.0	9.7
Madison	17.4	19.4	5.0	9.9
Detroit, Mich.	17.0	19.0	4.0	10.5
Grand Rapids	16.7	18.7	4.0	10.2
Saginaw	17.0	19.0	4.0	10.5
Evansville, Ind.	17.7	19.7	5.0	10.0
Indianapolis	17.9	19.9	5.0	10.2
South Bend	18.2	20.2	5.0	10.5
Fargo, N. Dak.	17.9	19.9	4.0	12.1
Huron, S. Dak.	18.8	20.8	5.0	11.4
Sioux Falls	18.4	20.4	5.0	10.9
K. C., Mo.*	15.7	17.7	4.0	9.2
Springfield	15.1	17.1	3.5	9.1
St. Louis	12.5	14.5	3.5	8.7
St. Joseph*	15.3	17.3	4.0	8.8
Wichita, Kans.	14.6	16.6	4.0	10.2
Bartlesville, Ok.	16.0	18.5	5.0	10.5

*State tax 2 cents, 1-cent city tax and 1-cent Federal tax.

Discounts to dealers, effective March 1, 1934: Undivided accounts, 4 cents a gallon on Red Crown Ethyl and Standard Red Crown, divided accounts, 3½ cents a gallon on Red Crown Ethyl and Standard Red Crown.

Stanolex Furnace Oil in Chicago

Effective March 5, 1934, prices f.o.b. Chicago, tank wagon prices: No. 1 (36-40 lt. stw. zero), under 100 gallons, 8¼ cents; No. 2 (30-34 stw. zero), 7¾ cents; No. 3 (22-26 zero), 7¼ cents; No. 4 under 300 gallons (12-16 zero), 6¾ cents; viscosity of No. 4, 90-115 at 100° F.; No. 5 under 300 gallons, 5½ cents; for deliveries of 100 gallons or more deduct 1 cent.

Naphtha

	Tank wagon*
Oleum spirits	16.9
V.M.&P. naphtha	18.0
Cleaners' naphtha	18.0
Stanisol	18.0

*Prices include 3-cent Illinois tax, but not 1-cent Federal tax.

Prices f.o.b. Chicago, September 13, 1933. Each of above prices subject to discount of 1 cent per gallon for 150-gallon lots if covered by contracts.

Southern District

STANDARD OIL CO. (KENTUCKY)

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero. tank wagon
Atlanta, Ga.	20.0	22.0	7.0	14.5
Augusta	20.0	22.0	7.0	14.5
Macon	20.0	22.0	7.0	14.5
Savannah	20.0	22.0	7.0	14.0
Birm'ham, Ala.	21.5	23.5	8.0	12.0
Mobile	20.5	22.5	8.0	12.0
Montgomery	22.5	24.5	8.0	15.0
Jackson, Miss.	19.5	21.5	7.0	14.0
Vicksburg	20.0	22.0	7.0	14.0
Jack'ville, Fla.	20.0	22.0	8.0	11.5
Miami	20.0	22.0	8.0	13.5
Pensacola	18.0	20.0	8.0	13.5
Tampa	20.0	22.0	8.0	12.5
Lexington, Ky.	18.5	20.5	6.0	11.5
Covington	17.5	19.5	6.0	11.5
Louisville	18.0	20.0	6.0	11.5
Paducah	13.5	15.5	6.0	11.0

In addition to the state tax of 4 cents on gasoline, Montgomery has city and county tax of 2 cents on gasoline and one-half cent on kerosene. Kerosene prices in Georgia and Mississippi include 1 cent state tax; in Alabama, an inspection fee of one-half cent on kerosene and one-fortieth cent on gasoline; in Florida an inspection fee of one-eighth cent on kerosene and gasoline. To Pensacola, Mobile and Birmingham state taxes on gasoline add 1 cent city tax.

Southwestern District

MAGNOLIA PETROLEUM CO.

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero. tank wagon
Dallas, Tex.	17.0	19.0	5.0	6.0
Fort Worth	17.0	19.0	5.0	7.0
Houston	16.0	18.0	5.0	8.5
San Antonio	17.0	19.0	5.0	8.5
El Paso	17.5	19.5	5.0	11.0
Muskogee, Ok.	16.0	18.0	5.0	7.5
Okla. City	16.0	18.0	5.0	8.5
Tulsa	16.0	18.0	5.0	8.5
Ft. Smith, Ark.	14.5	16.5	5.0	8.0
Little Rock	16.5	18.5	7.5	9.0
Texarkana	17.0	19.0	5.0	7.0

Atlantic Coast District

STANDARD OIL CO. OF NEW JERSEY

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero. tank wagon
Atl'tic City, N.J.	17.5	16.0	4.0	10.0
Newark	16.8	16.3	4.0	9.5
Annapolis, Md.	18.1	17.6	5.0	10.0
Baltimore	17.6	17.1	5.0	9.5
Cumberland	19.1	18.5	5.0	12.7
Wash'g'n, D. C.	15.8	14.5	3.0	11.5
Danville, Va.	20.2	19.7	6.0	12.9
Norfolk	18.7	18.2	6.0	11.3
Petersburg	19.5	19.0	6.0	11.4
Richmond	19.1	18.6	6.0	11.7
Roanoke	20.3	15.4	6.0	12.9
Charls'n, W.Va.	18.5	18.0	5.0	12.6
Parkersburg	17.8	15.9	5.0	11.2
Wheeling	18.5	18.0	5.0	12.2
Charlotte, N. C.	21.9	21.0	7.0	13.5
Hickory	22.2	21.0	7.0	13.7
Mt. Airy	22.2	21.7	7.0	13.8
Raleigh	21.7	21.0	7.0	13.3
Salisbury	22.0	20.0	7.0	13.6
Charleston, S.C.	19.7	19.2	7.0	11.3
Columbia	21.5	21.0	7.0	13.2
Spartanburg	21.9	21.0	7.0	13.5

Note—Dealer contracts are written at 2½ cents above the posted tank car price, less a voluntary allowance of one-half cent per gallon. This affects all points. Kerosene 1 cent off tank wagon for 25 gallons or more under contract except New Jersey and Baltimore, Md.

Ohio

STANDARD OIL CO. OF OHIO

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero. tank wagon
Ohio points	17.0	19.0	5.0	*13.5

*Includes state tax of 1 cent, effective July 22

Nebraska

STANDARD OIL CO. OF NEBRASKA

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero. tank wagon
Omaha	17.3	19.3	5.0	9.0
McCook	18.4	18.4	5.0	8.0
Norfolk	17.0	17.0	6.0	8.5
North Platte	18.0	18.0	5.0	8.5
Scottsbluff	18.3	19.3	5.0	11.0

Note: Discount to dealers, including any rentals under lease and agency agreements: Undivided accounts, Standard Red Crown and Red Crown Ethyl Gasoline 4 cents, Reliance (third brand) 3 cents, under service station price. Divided accounts, Standard Red Crown Ethyl Gasoline 3½ cents, Reliance (third brand) 2½ cents, under service station price. Discounts to consumers covered only by form CD-1, official commercial consumer contract.

Central South District

STANDARD OIL CO. OF LOUISIANA

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero. tank wagon
N. Orleans, La.	19.3	16.5	*7.0	†12.0
Baton Rouge	18.7	18.2	6.0	†12.0
Alexandria	19.6	19.1	*7.0	†10.0
Lafayette	19.8	19.3	*7.0	†12.0
Lake Charles	19.7	19.2	*7.0	†12.0
Shreveport	17.5	15.0	6.0	†12.0
Knoxville, Tenn.	23.2	22.7	8.0	13.0
Memphis	21.6	20.0	8.0	9.5
Chattanooga	23.0	22.5	8.0	11.0
Nashville	22.5	16.5	8.0	11.0
Bristol	23.0	19.0	8.0	14.0

*Includes city tax of 1 cent. †Louisiana kerosene prices include 1-cent state tax.

Note—Dealer contracts are written at 2½ cents above the posted tank car price.

Pacific Coast Territory

STANDARD OIL CO. OF CALIFORNIA*

	Gasoline: Tank wagon†	Gasoline: Posted retail	Gasoline: Incl'ds tax of	Kero. tank wagon
San Francisco	12.0	15.0	4.0	12.5
Los Angeles	10.0	13.0	4.0	12.5
Fresno, Calif.	12.0	15.0	4.0	14.6
Phoenix, Ariz.	18.5	21.5	6.0	‡16.0
Reno, Nev.	17.5	20.5	5.0	15.5
Portland, Ore.	19.0	22.0	5.0	13.5
Seattle, Wash.	15.5	18.5	6.0	13.5
Tacoma	15.5	18.5	6.0	13.5
Spokane	21.0	24.0	6.0	18.0

*Retail prices posted by Standard Stations, Inc., a subsidiary.

†Prices are at company's plant or depots, as company does not operate stations. A 4-cent per gallon discount is given dealers and customers taking tank wagon lots except in Phoenix where the discount is 1 cent. ‡Includes 5 cents state tax.

Pennsylvania, Delaware and Part of New England

ATLANTIC REFINING CO.

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero. tank wagon
Philadelphia, Pa.	14.5	16.5	4.0	10.0
Pittsburgh	15.0	17.0	4.0	10.0
Allentown	14.5	16.5	4.0	10.0
Erie	15.0	17.0	4.0	9.0
Scranton	15.0	17.0	4.0	10.0
Altoona	15.0	17.0	4.0	10.0
Dover, Del.	15.0	17.0	4.0	10.0
Wilmington	15.0	17.0	4.0	9.0
Boston, Mass.	14.5	16.5	4.0	8.0
Springfield	14.5	16.5	4.0	8.5
Worcester	15.5	17.5	4.0	9.0
Hartford, Conn.	14.4	16.4	3.0	9.0
New Haven	14.2	16.2	3.0	9.0
Providence, R.I.	12.0	14.0	3.0	8.0

Note—Tank wagon prices are those applicable to consumers purchasing lots of 100 or more gallons in one delivery.

New York and Part of New England

STANDARD OIL CO. OF NEW YORK

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero. tank wagon
Albany, N. Y.	16.1	17.1	4.0	9.0
Met. New York*	14.5	15.5	4.0	8.0
Buffalo	16.0	17.0	4.0	8.5
Rochester	16.0	17.0	4.0	8.5
Syracuse	16.0	17.0	4.0	9.0
Boston, Mass.	15.5	16.5	4.0	8.0
Portland, Me.	17.2	18.2	5.0	8.5
Manch't'r, N.H.	18.2	19.2	5.0	9.0
Burlington, Vt.	18.8	19.8	5.0	9.5

*Prices on gasoline in Brooklyn, Queens and Nassau Counties 1 cent per gallon lower; in Suffolk County one-half cent lower.

Canada*

IMPERIAL OIL, LTD.

Imperial 3-Star Gasoline

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero. tank wagon
Hamilton, Ont.†	26.5	27.5	6.0	17.5
Toronto, Ont.†	26.5	27.5	6.0	17.5
Brandon, Man.*	31.0	34.5	7.0	22.5
Winnipeg, Man.	28.7	31.7	7.0	20.2
Regina, Sask.	29.0	32.0	6.0	21.5
Saskatoon, Sask.	31.8	34.8	6.0	24.3
Edmonton, Alta.	31.2	34.2	6.0	22.7
Calgary, Alta.	28.5	31.5	6.0	21.0
Vanc'ver, B.C.†	30.0	31.0	7.0	24.0
Montreal, Que.	24.0	27.0	6.0	17.0
St. Johns, N. B.	26.5	30.5	7.0	21.0
Halifax, N. S.	25.5	29.5	6.0	21.0

*Imperial gallon used in Canada. †Dealer discount posted tank wagon on gasoline in Ontario and British Columbia subject to dealer's discount of 3 cents per gallon.

Retail Price Changes

Regular-Grade Gasoline and Kerosene

Continental Oil Co., April 27, advanced gasoline tank wagon and station prices 1½ cents in Twin Falls.

Standard Oil Co. of Ohio, May 4, advanced gasoline tank wagon and station prices one-half cent throughout Ohio.

Standard Oil Co. (Kentucky), April 26, reduced gasoline tank wagon and station prices one-half cent in Jackson.

Standard Oil Co. of New Jersey, May 1, reduced kerosene tank wagon price one-half cent in Baltimore.

Standard Oil Co. of Louisiana, April 21, advanced gasoline station price 2 cents in Bristol; April 28, reduced it 8 cent; April 30, reduced it 1.2 cents. April 26, reduced gasoline station price 2 cents in New Orleans. April 27, reduced gasoline station price 1 cent in Shreveport. April 27, reduced gasoline station price 2.6 cents in Alexandria; April 30, advanced it 2.6 cents.

Standard Oil Co. of New York, Inc., May 7, advanced gasoline tank wagon and station prices 1 cent in Queens, Kings (Brooklyn) and Nassau Counties and one-half cent in Suffolk County, making prices the same again throughout metropolitan New York.

CRUDE OIL PRICE CHANGES

The Stanolind Oil & Gas Co., on May 5, but retroactive to May 1, announced a new price for Frannie, Wyo., light crude, 70 cents per barrel. Frannie heavy crude remains at 62 cents per barrel.

Plan Session of Oil Company Buyers' Group

A session of the oil company buyers' group of the National Association of Purchasing Agents will be held in Tulsa on Tuesday night, May 15, at 7:30 p.m., under the auspices of the Purchasing Agents Association of Tulsa. O. E. McClatchey, purchasing agent for Barnsdall Oil Co. and regional chairman of the group for the Mid-Continent section, will preside. The topic for discussion is the code of the American petroleum equipment industry and trade. Major Stiles M. Decker, NRA representative assigned to that body, will be the chief speaker. G. A. Tompson, purchasing agent for the Empire Companies, Bartlesville, Okla., will present the buyers' viewpoint. Clyde Elwood, supervisor of the code authority for the Mid-Continent and Rocky Mountain areas, will also participate in the meeting. A general discussion will follow presentation of the formal papers. The meeting, which will be held on the fourth floor of the Tulsa Building, is open to all those interested in the subject.

AMAZON APPEAL HELD

NEW ORLEANS, La., May 7.—Legality of the oil code was defended and challenged here before the U. S. Fifth Circuit Court of Appeals to argue the injunction granted last February to the Amazon Petroleum Corp., Panama Refining Co. and a number of co-complainants.

Circuit Judges Nathan P. Bryan, Rufus E. Foster and Samuel H. Sibley heard the appeals.

E. H. CORNELIUS DIES

Ernest H. Cornelius, president of the Oklahoma Steel Castings Co., died Tuesday in a Cleveland, Ohio, hospital following an appendicitis operation two weeks ago. He was 44 years old.

Mr. Cornelius was stricken in Cleveland attending a code meeting for his industry. His condition was critical for several days, but it was later believed he was recovering.

NATURAL GASOLINE MANUFACTURE

Lowe Named Secretary of Gasoline Association

William F. Lowe has been named secretary of the Natural Gasoline Association of America to succeed Ray Miller, who resigned May 1 to become sales manager for Hanlon-Buchanan, Inc. Mr.

WILLIAM F. LOWE

Lowe is well qualified for the work, having received training in a number of branches of the oil business and his technical schooling permits a continuation of the direction of the technical operating problems handled by the association.

Mr. Lowe is a graduate of the University of Michigan, where he majored in geology and engineering. Following his graduation he entered the organization of the Midwest Refining Co. at Salt Creek, Wyo., where he obtained several years of practical experience in oil production. Early in 1927 he was transferred to the geological department of the Midwest Exploration Co. at Amarillo, Tex. In 1929 he accepted a position as staff writer on the National Petroleum News with headquarters in Tulsa. He then served as engineering editor for International Petroleum Technology. Mr. Lowe was later transferred to the Cleveland office of the company and for the past year has been engaged in marketing problems connected with the oil code.

Pure to Utilize Residue Gas for Repressuring

Pure Oil Co. has started an experiment in repressuring its wells in Section 15, Greendale Township, with residue gas from O. H. Grimes' new gasoline extraction plant recently placed in operation in the Chippewa-Greendale Field of Michigan.

Gas is being introduced into the pay horizon through a central well under high pressure. The question is whether the limestone formation, where production may be coming from a number of disconnected, uncommunicating crevices or cavities, will be susceptible to this method of treatment.

The Pure experiment is being watched closely with possible successful results certain to be followed by the installation of more combination repressuring and natural gasoline plants. A battery of 19 storage tanks has been erected, the laboratory finished and ready for operation.

Technical Committee on Natural Gasoline Reports Work Done Over Past Year

By R. C. ALDEN
Phillips Petroleum Co.*

During the past year your technical committee has done very little actual work. The individual members of the committee have been burdened by company duties.

Practically the only activity of the committee during the year was a continued study of the minor discrepancies which occur in the use of the Reid vapor pressure method. During the year the committee reviewed all of the available information and came to the conclusion that, except for some very minor points, the only flaw in the method was due to variable air saturation of the gasoline sample prior to the test. Even this error was of no great significance in the case of products of relatively high vapor pressure. An extensive series of tests was made to investigate this factor.

Since the errors were slight in respect to most natural gasoline products but might be significant in the application of the method to motor fuels, the committee reported its findings to Subcommittee 22 of A.S.T.M. Committee D-2. The committee's hope was that sufficient interest would be stimulated among motor fuel manufacturers so that they would conduct the necessary experiments to determine whether the method needed further modification before it could be applied to motor fuels as a standard test.

Committee D-2 instructed its subcommittee to continue its investigation for another year. Instructions were given to the subcommittee to determine whether or not the description of the method could be written more carefully so as to avoid misinterpretations which had caused many difficulties, and to be prepared to make recommendations in respect to the air solubility factor in the testing method. The first phase of this work is in progress and plans are being made in respect to the second phase.

During the past year considerable interest has been manifested in the vapor lock problem by refiners. The vapor lock work, sponsored by the association and done by the Bureau of Standards last year, was largely responsible for arousing this interest. An important factor here was the growing realization among refiners that butanes produced in cracking were available in large quantities and could not be used in motor fuels because of improperly designed automotive fuel systems. A strenuous effort, led by refiners, is now under way to enlist the co-operation of the automobile industry toward creating motor fuel markets for butane.

In this connection two papers will be delivered at the A.P.I. meeting at Pittsburgh later in the month, one by William Mendius of Sinclair Refining Co., and the other by the writer. At the June A.S.T.M. meeting there will be a symposium on the subject to vapor lock, in which Doctor Brown will take the leading part in presenting the conclusions of all of the available investigations. The problem will be interpreted from both the automotive and petroleum viewpoints.

An outstanding fact which has developed from the discussions on vapor lock to date is that there is enough butane to constitute 20 per cent of the motor fuel supply.

With the uncertainties that still prevail in the industry it is a little difficult to suggest programs for the future. When we have returned to a more optimistic frame of mind there will be many important projects which deserve the attention of your technical committee. For the present it seems necessary to mention only the importance of keeping active the two major projects which are in progress.

*Report of chairman of technical committee of Natural Gasoline Association of America, delivered before association convention, Tulsa, May 9-11.

Liquid Gas to Be Provided Mexico City Householders

MEXICO CITY, Mexico, May 5.—Local householders who have been without cooking gas since the city's gas plant was destroyed in 1911 will soon be serviced with gas in cylinders, according to a report to the Commerce Department from Assistant Commercial Attache R. G. Glover, Mexico City.

The Mexican Petroleum Co., the report states, has been experimenting for some time in connection with the furnishing of cooking gas in cylinders and has definitely proved that it will be not only possible but profitable to provide such a service.

The old mains which formerly carried the gas in Mexico City are no longer serviceable, and the petroleum company has decided that the most practical and least expensive method of distributing gas is by means of metal cylinders.

The cylinders to be used hold approximately 45 kilos of cooking gas. The customer is not compelled to buy the cylinder or make a cash deposit thereon, but instead the company will deliver the gas at the retail price of about 6½ United States cents per pound. It is reported that one of these cylinders of 45 kilos of gas is sufficient to supply one burner for 330 hours.

The cylinders which have been used during the period of experimentation have been filled at one of the refineries of the petroleum company and shipped into Mexico City for distribution. Now the company intends to construct a large storage tank in the capital city and has already purchased a tank car in which the gas will be brought from its plant at Tampico. The cost of the cylinders and the storage tank will represent a considerable outlay of capital and as business develops, additional cylinders will be necessary. So far, all of this equipment has been imported from the United States and in all probability this company will continue its purchase from the same source.

CHIEF ADDING UNIT

The Chief Refining Co. is adding another absorption unit at its Gladewater plant in the East Texas Field to bring the total to five. The plant is operated in conjunction with the company's refinery. The construction work will be completed within another 10 days.

List Manufacturers of Liquefied Petroleum Gas

Despite fewer manufacturers of liquefied gas at the close of 1933 sales of the product were boosted 14.1 per cent over 1932, or were 38,931,008 gallons in the year just completed. These data were compiled by the petroleum economics division of the Department of Commerce and were published here one week ago. In the following list are the names, addresses and trade names for the products of companies manufacturing liquefied petroleum gases, also compiled by the department:

Producers of Liquefied Petroleum Gases

Atlantic Refining Co., 260 South Broad Street, Philadelphia, Pa., no trade name.

Carbide & Carbon Chemicals Corp. (unit of Union Carbide & Carbon Corp.), 30 East Forty-second Street, New York, trade name "Pyrofax."

Carter Oil Co., Tulsa, trade name same as Hope Construction & Refining Co.

Cumberland Gasoline Corp., 1524-28 Hanna Building, Cleveland, Ohio, no trade name.

The Empire Companies, Bartlesville, Okla., no trade name.

General Petroleum Corp., Higgins Building, Los Angeles, Calif., no trade name.

Hope Construction & Refining Co., 545 William Penn Way, Pittsburgh, Pa., trade names, "Hopane," "S-O-Tane," and "Protane."

Humble Oil & Refining Co., Houston, Tex., no trade name.

Lone Star Gas Co., 1915 Wood Street, Dallas, Tex., trade name, "Stargas."

The Mars Co., 308 Seneca Street, Oil City, Pa., no trade name.

Petrolane, Ltd. (subsidiary of Lomita Gasoline Co.), Long Beach, Calif., no trade name.

Philgas Co. (subsidiary of Phillips Petroleum Co.), General Motors Building, Detroit, Mich., trade name, "Philgas."

Shell Oil Co., Shell Building, San Francisco, Calif., trade names, "Shellane" and "Petrogas."

Shell Petroleum Corp., Thirteenth and Locust Streets, St. Louis, Mo., trade name, "Shellane."

Skelgas Co. (subsidiary of Skelly Oil Co.), 2534 Madison Avenue, Kansas City, Mo., trade name, "Skelgas."

Sloan & Zook Co., Kane, Pa., no trade name.

Standard Gasoline Co. (subsidiary of Standard Oil Co. of California), 225 Bush Street, San Francisco, Calif., trade names, "Flamo" and "Bu-Gas."

Standard Oil Co. (Indiana), 910 South Michigan Avenue, Chicago, Ill., no trade name.

Sun Oil Co., 1608 Walnut Street, Philadelphia, Pa., no trade name.

Union Oil Co. of California, Union Oil Building, Los Angeles, Calif., no trade name.

Viking Distributing Co. (subsidiary of Columbia Oil & Gasoline Corp.), Charleston, W. Va., no trade name.

AMERICAN STARTS PLANT

SHAMROCK, Tex., May 7.—The new 50,000-gallon well pressure absorption plant of the American Natural Gasoline Co., located in Section 100, Block 23 of the H.&G.N. Survey, near Ramsdell, will start operations today. The plant has been under construction for the past 69 days, setting a record for rapid construction in that line of work.

Small Tanks May Be Mounted at Low Cost

(Continued from Page 42)

Tensile strength of steel 29,000 pounds per square inch.

These values are conservative working values and the loading of tanks with liquids is a quiescent gradual one, and unless local ordinances for structures apply also to tanks and their foundations, these values should be used as a measure of economy.

Spacing Supports

Having cast the concrete footings, the steel beams are laid at the spacing limited by the supporting limits for the bottom tank plates, whether 12 inches to 18 inches on centers; the clear spans between flanges of the beams are considered as unsupported spans. Then the tank may be hoisted into place on the beams. Hardwood fillers of the width of the beam flanges, or slightly wider are fitted between tank bottom plates and steel beams to provide an even bearing.

Calculating Load

For calculating the loading on the tank foundation, the weight of tank and steel beams may be divided over the entire area. This weight of steel is a fraction of the total loaded tank weight. The weight of liquids for 10 feet depth, per square feet of tank bottom may be taken as follows:

	Weight	
	Per gallon	Per sq. ft.
Water	8.328 lbs.	624 lbs.

For other liquids, use:

624 lbs. × Sp. Gr. = wt. per sq. ft., lbs.

Properties of steel and formulas for design are given in the American Institute of Steel Construction Handbook. The working stresses given in this article may be substituted for those values recommended for large structures demanding greater safety factors because of shock loading, and more uncertainty as to actual loading values, as well as greater effects of failures.

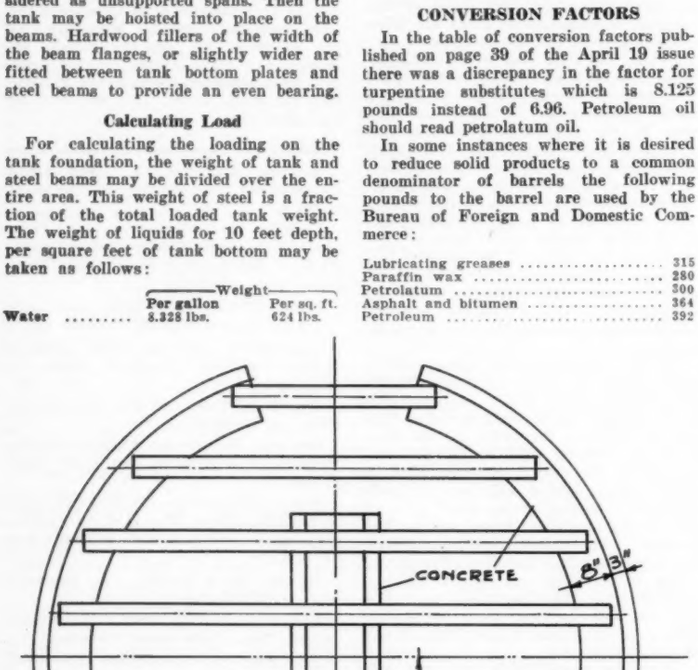
Another factor that would be suggested in using economical safe design as suggested herein, is that saving in weight of metal might be used for offsetting extra cost of better and more suitable alloy metals, or more tank equipment and better valves.

CONVERSION FACTORS

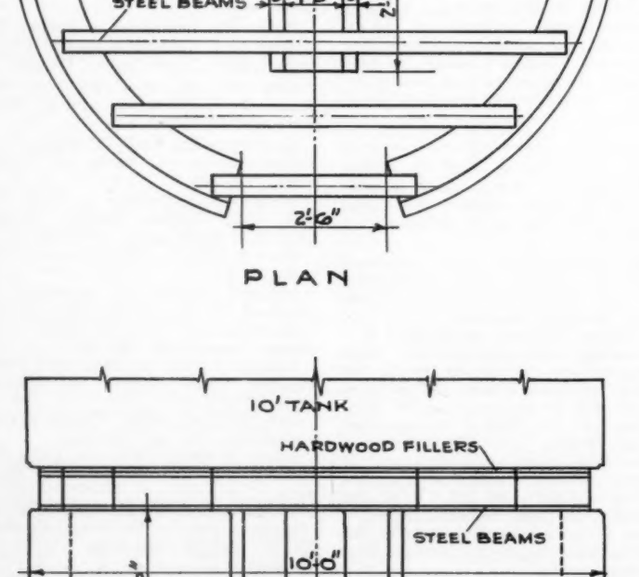
In the table of conversion factors published on page 39 of the April 19 issue there was a discrepancy in the factor for turpentine substitutes which is 8.125 pounds instead of 6.96. Petroleum oil should read petrolatum oil.

In some instances where it is desired to reduce solid products to a common denominator of barrels the following pounds to the barrel are used by the Bureau of Foreign and Domestic Commerce:

Lubricating greases	315
Paraffin wax	280
Petrolatum	300
Asphalt and bitumen	364
Petroleum	392



PLAN



ELEVATION

(Small tank foundation)

Contracts Must Enable Use of Natural All Year

(Continued from Page 42)

pounds appear to be dictated by competition.

In view of these facts, our technically minded friends claim that natural gasoline having a vapor pressure of 12 pounds, for example, should be used as a base price for our commodity. On this basis suitable deductions would be made from the price of 12 pounds when higher vapor pressure material is required.

In as much as 12-pound natural gasoline is a motor fuel in itself, it is reasonable to assume that it should command the motor fuel price and at least one manufacturer in Oklahoma has been selling his natural on this basis for some time. This manufacturer has made contracts having a base price for low vapor pressure natural gasoline equivalent to the U. S. Motor gasoline price, with the provision that if the buyer desired higher vapor pressures, factors based on volumetric corrections would be applied to the U. S. Motor price to give the manufacturer the same comparable netback for his high vapor pressure natural.

Should Appeal to Refiner

Other things being equal, this type of contract should appeal to the refiner in as much as there is a direct relationship between the cost of his natural gasoline and the selling price of his refinery gasoline. In the past, refiners have complained bitterly of the wide fluctuations in the price of natural gasoline and have said that they would prefer buying on some contract basis that would be tied in with the price of the product into which the natural gasoline was put. This contract, however, has the disadvantage of making the refiner pay more for his natural gasoline during certain seasons of the year than he would pay if buying on the 26-70 basis. As contrasted with this disadvantage, during the fall of the year when the refinery requirements of natural gasoline are heaviest he can purchase with a considerable saving as compared to the price on the spot market.

The direct benefits to the natural gasoline manufacturer on this type of contract are questionable. It has worked out, during the last three years or so, that during the period of low prices, the price has been so low that the manufacturer could absorb fractionating losses in making 12-pound and still get more than the 26-70 equivalent for his natural gasoline by selling 12-pound on the U. S. Motor price, but even though his contract price was higher than the market price he was still selling at a loss much of the time. Then in the fall of the year, the haymaking season for natural gasoline manufacturers, it frequently happened that the 26-70 price was equal to, or sometimes higher, than the U. S. Motor prices. At such a time the manufacturer took a licking when he shipped 12-pound natural gasoline at the U. S. Motor price. Contracts of this sort more nearly tend to equalize the price over a period of time if the contract calls for the same number of cars per month over the contract.

Owing to the fact that casinghead gas contracts are based on the market price for 26-70 it would not be practical for the industry to discontinue basing prices on this grade, until such a time as casinghead gas contracts could be rewritten on a different basis. At the same time there is much merit in the idea of using a lower vapor pressure product as a basis for our price calculations in place of 26-70.

A type of contract has been suggested which combines the present base price for 26-70 with the base price which the technical men think should be used. On this contract the refiner would pay the 26-70 price for 26-70 natural gasoline. At the other end of the scale, if he bought 12-pound natural he would pay the U. S. Motor price or possibly a slight differential under the U. S. Motor price. The price of gasoline of intermediate vapor pressures would be determined by simple arithmetic between the two prices thus established and in proportion to the vapor pressure purchased. Thus the price of 18-pound gasoline would be the market price for 26-70 plus 8/14 of the difference between the market for 26-70 and the price level established for 12-pound natural, there being 14 pounds difference in vapor pressure between the 12 and 26-pound natural and 8 pounds difference in vapor pressure between the 18 and 26-pound grades.

This contract would partially satisfy the gambling instincts of both buyer and seller and at the same time would tie natural gasoline prices to the more stable motor fuel prices. As far as I know, this type of contract has never been used and there may be some disadvantages in it that are not apparent at the present time, but which would show up once the contract became effective.

Depends on Freight Rates

The ability of the refiner to use natural gasoline at a profit is largely dependent upon the freight he has to pay on natural gasoline shipped into his plant. Where the freight is 1 cent a gallon or less, as is the case with most Mid-Continent refiners, the difference between the cost of refinery made volatility and volatility obtained by means of natural gasoline is so small as to insure the continued use of our products. Where the freight to the refinery is 2 cents a gallon or more the cost of producing volatility in the refinery is lower than the cost of natural gasoline plus the freight to refinery unless the natural gasoline market is considerably under the motor fuel market. It follows then that the more freight the refiner has to pay on the natural gasoline the less he is going to use.

In a report made recently to the Western Petroleum Refiners Association by a committee composed of A. T. Scherer and A. P. Reuther, it was shown that Mid-Continent refiners use about 11 per cent natural gasoline in their motor fuel while Illinois and Indiana refiners use approximately only 3.5 per cent. This problem can be solved in one of two ways. The refiner can ship natural gasoline direct to his bulk plants in large consuming centers for blending with his refinery gasoline, thereby avoiding a second payment of freight on the natural gasoline used, or he can purchase natural gasoline in the same producing field that supplies his crude and move the natural gasoline through his crude pipe line with the crude to his refinery.

Refiners Should Co-operate

The burden of deciding the type of natural gasoline contract which will assure us of the continued use of our product should not be borne by the natural gasoline manufacturers alone. The refiner is rather blind who cannot or will not see the harmful effects on his own refinery gasoline price structure that low natural gasoline prices can produce. Natural gasoline is going to find its way into motor fuel. The natural channel for it to follow is through the refinery and then to the bulk stations and filling stations, or direct to the larger bulk plants of the refiner. If this channel is not large enough or broad enough for the natural gasoline to move through it, then naturals will find another channel. In other words, the natural gasoline manufacturer must go into the motor fuel market direct with his product and sell it at whatever price he can obtain.

Since motor fuel made entirely from natural gasoline is admittedly a superior motor fuel, particularly during the winter months, and since it frequently sells at prices which are below the prices for low octane gasoline, it follows as a matter of course that natural gasoline motor fuel can have only a harmful effect on the refinery gasoline price structure.

This is particularly true when the fact is borne in mind that many purchasers of natural gasoline motor fuel operate as price cutters. Consequently it is to the interest of the refiners to have natural gasoline contracts on a basis that will not only enable them to use our products profitably but let us make a living as well.

Ease of Shipment to East Creates Problem

(Continued from Page 43)

according to the same authority, showing a weeding out of old obsolete plants in favor of a few new modern plants of larger capacity. Practically all of these plants are located on main gathering and distributing gas lines of the utility companies of this territory. This of course means only one thing, that as domestic gas sales increase so does the production of natural gasoline.

Glance at the production figures for 1932, 1933 and 1934, as set forth here in table No. 2.

TABLE NO. 2—PRODUCTION OF NATURAL GASOLINE (in Million of gallons) APPALACHIAN DISTRICT
(Bureau of Mines figures)

	1932	1933	1934
January	7.4	6.4	5.9
February	7.2	6.0	6.2
March	7.8	6.3	..
April	6.2	5.3	..
May	4.8	4.2	..
June	3.7	3.2	..
July	3.5	3.5	..
August	3.8	3.5	..
September	3.8	4.1	..
October	5.4	5.3	..
November	6.2	5.6	..
December	6.9	5.8	..
Total	66.7	59.2	

These figures point out two things, namely that the production in the winter months is double that of the summer months and that the production for the past two years has declined approximately 11 per cent.

Then referring again to the Bureau of Mines information, I have prepared table No. 3, showing another story of this district.

TABLE NO. 3—PRODUCTION OF MOTOR FUEL AND QUANTITY OF NATURAL GASOLINE USED IN APPALACHIAN AREA IN BARRELS

	1932 Gasoline Output Straight Run and Cracked	1932 Nat. Gas. Used	1933 Gasoline Output Straight Run and Cracked	1933 Nat. Gas. Used
January	1,323,000	31,000	1,392,000	25,000
February	1,374,000	32,000	1,157,000	19,000
March	1,459,000	25,000	1,216,000	14,000
April	1,473,000	28,000	1,251,000	14,000
May	1,563,000	23,000	1,369,000	17,000
June	1,488,000	26,000	1,540,000	15,000
July	1,431,000	30,000	1,698,000	16,000
August	1,333,000	26,000	1,639,000	16,000
September	1,250,000	33,000	1,648,000	27,000
October	1,438,000	65,000	1,608,000	21,000
November	1,348,000	40,000	1,459,000	26,000
December	1,259,000	28,000	1,282,000	27,000
	16,745,000	377,000	17,261,000	237,000

This shows that, while the gasoline output of the Appalachian refiners has increased approximately 3 per cent, they have curtailed their use of natural gasoline 37 per cent. In other words, the percentage of natural gasoline used in the output of these refineries, has dropped from approximately 2¼ per cent in 1932 to 1⅜ per cent in 1933.

Turn to Stabilization

To cope with this slackening demand from the refiners and to keep from having to go so far west for markets that their freight differentials would be used up completely, the manufacturers of this district have turned to stabilization. It is said that some companies have curtailed their production by stabilizaton as much as 50 per cent. Natural gasoline of 18-pound and 20-pound Reid vapor pressure is going to the refiners and jobbers and 9-pound to 12-pound material is being marketed through company-owned filling stations. One company is marketing propane, butane and pentane.

But in spite of this stabilization program their unbalanced production is still a serious problem, because in common with the Mid-Continent producers they do not have, on an average, sufficient storage to take care of their peak production for later distribution more evenly over the year. This peak, as you have noticed, comes in the winter period of light motor consumption. While the average large refiner is building up his volatility in September and October for winter demand, the Appalachian natural gasoline production is just getting under way and when the refiner is curtailing his use of light fractions for spring stocks in January and February, the Appalachian plants are going full blast. So it is only with adequate storage, in connection with his stabilization that the Appalachian manufacturer can hope to combat this problem and take advantage of the heavier consuming seasons of both motor gasoline and blending material within his most favorable marketing territory.

Derrick on Specially Built Barge Is Solution

(Continued from Page 40)

cent from the boilers. In this process, the blow-down water in turn is retreated before returned to the boilers.

From the treating plant the water is separated into two streams, one going directly into the boilers and the other into the high pressure mine-water heaters. The sludge from the treaters is conserved in a mud pit to be used as drilling fluid for sulphur wells.

Power Plant

The power plant consists of five 600 horsepower Babcock & Wilcox Class H boilers of the fusion welded drum construction which generate a pressure of 100 pounds. Most of the steam from the boilers passes into the mine heater, where the 200 degrees preheated water from the treating plant is raised in temperature to around 320 degrees. This superheated water is pumped from the heaters to the sulphur station in the lake under pressure of 250 pounds.

Pumps used are Cameron centrifugals driven by Curtis impulse-type, single stage turbines, which exhaust at 5 pounds back pressure. This exhaust is used in the water softeners as a preheating medium. Ingersoll-Rand steam-operated, three-stage compressor units provide the compressed air for flowing the wells.

Duplicate boilers, heaters and pumping equipment are provided to insure continuous operation of the plant because if the plant should shut down for any period the sulphur in the lines and wells would solidify resulting in considerable expense and damage to the operations. Extra precautions are taken in every way to guard against any such emergency.

Originally Drilled for Oil

Production of sulphur at Jefferson Island began October 20, 1932. The plant has a rated capacity of approximately 300 long tons daily but has run as high as 1,400 long tons daily. Since the beginning approximately 200,000 tons has been taken out.

Jefferson Island, one of the "Five Islands" group of salt domes, is the second oldest known salt dome on the Gulf Coast, being discovered as early as 1895, but to date has been a failure as a producer of oil. In the development of sulphur, started a year and a half ago, the dome now has been placed among those of commercial importance from a mineral standpoint.

The discovery and development of sulphur at this dome followed a drilling program carried on over a period of several years by the Jefferson Island Oil Co. in exploration for oil around the dome. The well in which sulphur was found was drilled only as a last attempt to get oil, and as all previous tests had been dry, the finding of sulphur came as a welcome surprise and changed the company from the oil to the sulphur business. However, both the oil and sulphur industries are closely allied on the Gulf Coast.

Jefferson Island Oil Co. is owned by New Orleans, La., interests. Lawrence O'Donnell is general superintendent of the Lake Peigneur operations; J. H. Pollard is assistant superintendent, and G. E. Etie, field superintendent.

OIL ELECTRIC TRAINS IN GREECE

The Peloponnesus Railways, a report from Athens says, has placed contracts for 14 oil-electric motor trains for main line and local services. The trains have capacities varying from 130 to 280 horsepower and will provide seating capacity for 60 first and second-class passengers.

Administrator Ickes Accepts Invitation

(Continued from Page 36)

and Saturday nights, May 17, 18 and 19, during the exposition.

During the last three days of the show there will be demonstrations of tractors traveling at over 60 miles per hour.

JAMES H. GARDNER
Chairman Reception Committee

Phillips Petroleum Co. is sending its aviation manager, Billy Parker, in a 1912 model Curtis Army type airplane from the Frank Phillips Woolaroc museum. Parker will do stunts in this plane, including a loop-the-loop during the show.

James H. Gardner has been named chairman of the reception committee.

Still Working on the Binger Wildcat Well

(Continued from Page 38)

This record shows that there was 86½ bbls. or 534.4 cubic feet of crude oil pumped into the tubing to displace 2,000 gallons or 267.4 cubic feet of hydrochloric acid. The pump pressure was built up to 2,100 pounds per square inch at the tubing head before the well was shut in for 72 hours.

Two slight leaks were observed in well head fittings, one in a four-way tee on tubing hookup and the other in a 6⅝-inch nipple in forged steel casinghead.

The well was shut in from 11:15 a. m., May 1, until about 7 p. m., May 4. When opened up it made 285 bbls. of oil in 45 minutes and about 300 bbls. of oil within the hour. It was left open the balance of the night without producing additional oil and shut in Saturday morning, May 5.

The well was again opened Sunday, May 6, and flowed about 100 bbls. of fluid part acid and part oil.

Since then the well has shown a pressure of about 350 pounds on the gauge on the casinghead and makes from 5 to 10 bbls. when the valve is opened after being shut in for short periods, from 30 minutes to 1½ hours. The pressure in the annular space between tubing and casing registered on the casinghead guage does not drop below 350 pounds either before, during or after these small flows through the tubing.

In the opinion of the well owners the difficulty experienced in getting this well to flow naturally is due to forcing mud and cement into the pores of the producing formation in cementing back of the casing. This was unavoidable under the conditions existing after the casing had been run. Nothing so far done has succeeded in removing all this material from the pores of the sand, but it is believed that in time this material can be removed and the well made to flow naturally through the tubing.

Majority of Industry Favors Ickes' Bill

(Continued from Page 39)

icy Board, are expected to be announced in the very near future. The recommendation of the board has been held up by the labor situation in Cleveland and other cities, but it will probably be sent to the secretary soon.

The Revenue Act of 1934 has been passed by both Houses of Congress and is expected to be signed by the President. This act contains new levies on the production and refining of crude oil to become effective 30 days after enactment. Provision is made for the registration and bonding of manufacturers of gasoline and lubricating oils; interchange of information between State and Federal agencies designed to eliminate tax evasion and the definition of gasoline is somewhat changed.

Although motions either to eliminate entirely or reduce the gasoline tax failed on the floor of the Senate while the bill was under consideration, the industry has made progress during the last two years. This is clearly demonstrated by the fact that 29 Senators voted to eliminate this tax.

The Bureau of Internal Revenue has asked the industry to co-operate in drafting new regulations under the gasoline and lubricating oil sections of the Revenue Act. In line with this suggestion, the American Petroleum Industries Committee will meet in New York City this week to consider the Act as passed and make recommendations designed to prevent abuses and evasion under the new language.

Committee Changes

The Planning and Coordination Committee has announced changes in its subcommittees as follows:

Production Subcommittee "B" the following additions were made: J. D. Collett, independent producer, and L. P. St. Clair, Union Oil Co.

Refinery Subcommittee "C" the following additions were made: F. R. Coates, Cities Service Co.; John E. Shatford, Ouachita Valley Refining Co., and Louisiana-Arkansas Refiners Association; I. A. O'Shaughnessy, Globe Oil & Refining Co., and H. F. Glair, Standard Oil Co. of Indiana.

Labor Subcommittee "F": (a) Resigned: W. T. Holliday as chairman, and B. L. Majewski as a member. (b) The labor subcommittee is now composed of the following: Chairman, I. A. O'Shaughnessy; senior vice president, H. H. Anderson of the Shell Petroleum Corp; vice chairman, H. F. Glair of the Standard Oil Co. of Indiana, and vice chairman, Bryan Houston of the Standard Oil Co. of Ohio.

Membership, in addition to the officers: E. G. Seubert, W. T. Holliday, A. E. Watts, J. D. Collett, M. K. Tillman of the National Association of Petroleum Retailers, H. B. Fell of the Independent Petroleum Association of America, R. C. Jopling of the Phillips Petroleum Co., J. H. Pew of the Sun Oil Co., S. W. Candee of the Tide Water Oil Co., H. R. Ivory of the Standard Oil Co. (California), and Dr. E. R. Lederer of the Texas Pacific Coal & Oil Co., Fort Worth.

Another Bill Introduced

Mr. Lesinski (Michigan) introduced the following bill in the House which was referred to the committee on ways and means. H.R. 9,473—To amend Section 9 of the National Industrial Recovery Act.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that Section 9 of the National Industrial Recovery Act is amended by adding at the end thereof the following new subsection:

"(d) The President may not regulate the shipment of petroleum and petroleum products in/or affecting interstate and foreign commerce out of any state unless the production in that state exceeds the amount normally consumed annually within the boundaries of that state."

XUM

Strength Replacing Weakness in Chicago Tank Car Gasoline Price Structure

By SPECIAL CORRESPONDENT

CHICAGO, May 7.—Strength was rapidly replacing weakness in the tank car gasoline price structure as the week opened. With major companies back in the market as buyers, the tone was much better and the general aspect seemed healthier. Cleaning up of several hundred cars of material mostly in East Texas in the preceding few days had removed some of the apprehension noted earlier, when prices reacted sharply. The current belief among many sellers is that the prospects are better than in a long time. Much hope of continued major company buying support is being expressed.

The support given the spot market lately, which has brought third grade motor gasoline back around the 4-cent level, has come almost wholly from major companies, since jobbers are still lagging in buying. Jobbers admit they are doing a good business, but local tank wagon and service station price cuts are making them nervous over buying anything more than the barest minimum, although their tanks are nearly dry in many cases.

Refiners Larger Buyers

Large refiners are now buyers or potential buyers in the tank car market on a larger scale because they are beginning to grow nervous over the amounts of material they may be able to hold over the coming summer months of anticipated good consumption. Gasoline output and stock allocations are being rigidly backed on what appears to be a gradually more restricted basis. Some majors who thought they had too much gasoline a few weeks ago now take the position that their stocks are too low and that under present conditions there is no suitable means of increasing them except by purchasing.

Reinforcing this condition, there is a somewhat better feeling as to tank wagon and service station markets. The local price cuts are still so numerous that the statistical departments of major companies are hard put to it to keep tabulations up to date, but in the past few days there have been indications the worst had perhaps been seen. One-half cent advance in Standard of Ohio territory was considered hopeful.

Kerosene

Although there are reports of low prices on kerosene, most larger sellers are holding firm in prices and appear actually to be purchasing material. The biggest part of the consuming season appears at an end, but views conflict on when or how serious the taper-off will be. The restoration of normal tank wagon kerosene and tractor fuel prices was of some aid, although some East Texas material has recently been offered more readily. There seems to be likelihood of more attention for a tractor fuel market generally.

Distillates

Prime white distillate is holding firm to strong for tractor and allied uses. The straw material is dull and unchanged. The zero gas oils are quiet, as are zero fuels, but prices are holding.

Coke

Petroleum coke is seasonally quiet.

Heavy Fuels

Heavy fuels remain much wanted products, with refiners regarding them more than ever desirable for cracking, in view of restrictions on crude. Prices in most cases are holding about unchanged. The steel industry is a ready buyer.

Lubs

Lubricating oils are strong, in the East particularly, while the Mid-Continent situation as viewed here is about steady and quiet. Motor oil retail sales are good.

Naphthas

Naphthas and solvents are showing more disposition to stabilize and at these price levels there is a continuing good demand.

Waxes

While waxes are not so strong as they have been recently, there is no price recession and stock accumulations do not seem to be troubling the market.

Crude Oil Prices

(Continued from Page 57)

Effective September 29 in Salt Flat by Shell Petroleum Corp.

Rocky Mountain States

Iles, light (Sept. 29, 1933)	$.96
Iles, heavy (Sept. 29, 1933)	.90
Florence, Colo. (June 17, 1933)	.30
Fort Collins and Wellington, Colo. (June 17)	(See Salt Creek prices)
Big Muddy (Sept. 29, 1933)	1.01
Frannie, light (May 1, 1934)	.70
Frannie, heavy (Sept. 29, 1933)	.62
Salt Creek and LaBarge (Sept. 9, 1933)	
See Stanolind Mid-Continent price schedule	
Grass Creek, light (Sept. 29, 1933)	1.18
Grass Creek, heavy (Dec. 15, 1932)	.45
Elk Basin (Sept. 29, 1933)	1.18
Rock Creek (Sept. 29, 1933)	1.02
Dutton Creek (July 3, 1933)	See Mid-Continent gravity prices
Lance Creek (Dec. 16, 1932)	.92
Poison Spider (Mar. 5, 1931)	.70
Hudson (June 2, 1931)	.65
Lander (Mar. 5, 1931)	.40
Rex Lake (Feb. 22, 1930)	1.10
Osage	1.08
Lost Soldier (Sept. 30, 1933)	.88
Hamilton Dome (Dec. 16, 1932)	.25
Torchlight (Sept. 29, 1933)	1.18
Greybull (Sept. 29, 1933)	1.18
Pondera	1.15
Sunburst (Sept. 29, 1933)	1.35
Cat Creek, Montana	1.07
Hogback (Sept. 29, 1933)	1.11
Lea County, N. Mex. (Sept. 29, 1933)	.75
Maljamar (Sept. 29, 1933)	.70
Artesia-Jackson (Dec. 1, 1933)*	.75

Note—Salt Creek, Torchlight, Elk Basin, Grass Creek, Frannie, Greybull, Hogback and Iles by Stanolind Oil & Gas Co. Elk Basin, Grass Creek light, Big Muddy, Rock Creek and Sunburst by Ohio Oil Co. Lost Soldier posted by Producers & Refiners Corp. Artesia, Jackson and Maljamar posted by Continental Oil Co. Lea County, effective September 29, 1933, by Humble Oil & Refining Co. and other buyers; Fort Collins, Wellington, Orchard, Florence, Big Muddy, Cat Creek, Rattlesnake and Table Mesa by Continental Oil Co. Osage posted by Arro.

*Continental Oil Co.

North Louisiana and Arkansas

Smackover, Ark. (all grades)	$.70
Tullos-Urania, La. (Jan. 13, 1934)	.37
Nevada, Ark. (Sept. 29, 1933)	.40
East El Dorado (Sept. 29, 1933)	.70
Converse, La. (Mar. 17, 1934)	1.03
Elm Grove, La. (Sept. 29, 1933)	.75
Holly, La. (Mar. 17, 1934)	1.03
Pleasant Hill, La. (Mar. 17, 1934)	1.03
Zwolle, La. (Mar. 17, 1934)	1.03
Champagnolle, Ark. (Mar. 17, 1934)	.31
Lisbon, Ark. (Mar. 17, 1934)	1.03
Stephens, Ark. (Sept. 29, 1933)	.70
Urbana, Ark. (Mar. 17, 1934)	.40
Other fields	(See gravity table)

Note—Smackover: Effective September 29, 1933, Texas Co., Magnolia Petroleum Co., Standard of Louisiana, Louisiana Oil Refining Corp., Gulf Refining Co. and Phillips Petroleum Co. East El Dorado posted by Magnolia Petroleum Co. and Gulf Refining Co., Nevada by Standard Oil Co. of Louisiana. Urania posted by H. L. Hunt, Inc. and Louisiana Oil Refining Co. Converse, Holly, Zwolle and Urbana by Standard Oil Co. of Louisiana; Elm Grove by Simmons Oil & Refining Co.; Pleasant Hill by Standard Oil Co. and Magnolia Petroleum Co.; Champagnolle by Standard Oil Co. and Lion Oil & Refining Co.

Eastern States

TIDE WATER PIPE CO.
(Effective May 1, 1934)

Bradford, Pa.	$2.55
Allegany, N. Y.	2.55

SOUTH PENN OIL CO.
(Effective May 1, 1934)

Pennsylvania Grade Oil in National Transit Lines (Bradford Field)	2.55
Pennsylvania Grade Oil in Southwest Pennsylvania Lines	2.32
Pennsylvania Grade Oil in Eureka Pipe Line lines	2.17
Pennsylvania Grade Oil in Buckeye Pipe Line lines	2.07
Corning Grade Oil in Buckeye Pipe Line Co.'s lines (Oct. 2, 1933)	1.33

PENNZOIL CO.
(Effective May 1, 1934)

Pennsylvania Grade Oil in National Transit Lines:	
Group A (Includes Cochran, Franklin, Hamilton and Doolittle districts.)	$2.47
Group B (Includes Titusville district.)	2.44
Group C (Includes Turkey and Tidioute districts.)	2.44
Group D (Includes Bear Creek and Porkey districts.)	2.44
Group E (Includes Eldeneau, Bull Creek, Rough Run, Carbon, Dipner, Bredin, McJunkin, Jameson Kennerdell, Emlenton, Tiona, Lacy and Kinzua districts. Price depends on length of pipe line haul to plant at Oil City.	2.42

PURE OIL CO.
(Effective May 1, 1934)

Cabin Creek, W. Va.	$2.17
Bradford Hollow, W. Va.	2.17
Kelly Creek, W. Va.	2.17

Middle Western States

OHIO OIL CO.
(Effective September 29, 1933)

Lima	$1.30
Illinois (Jan. 5, 1934)	1.13
Princeton, Ind. (Jan. 5, 1934)	1.13
Plymouth	Shut in
Western Kentucky	1.19
Midland, Mich. (Sept. 30, 1933)*	1.02
Oceana, Mich. (Oct. 5, 1933)	.80
Somerset, Ky. (Sept. 30, 1933)	1.33
Hart County, Ky. (Oct. 1, 1932)	1.19

*Posted by Pure Oil Co. Producers Pipe Line Co. pays 5 cents per barrel over Pure Oil Co.'s posted price. Somerset, Ky., crude purchased by Ashland Refining Co., Ashland, Ky., and posted price includes premium. Hart County, Kentucky, crude purchased by Stoll Refining Co. Oceana posted by Old Dutch Refining Co. and Naph-Sol Refining Co.

Canada

Ontario (September 9, 1933):	
Petrolia*	$2.10
Oil Springs	2.17
Turner Valley (Mar. 5, 1934):†	
Clear naphtha	$2.07
Discolored naphtha	2.03
Crude oil, 50 gravity	2.44
Crude oil, 45 to 49.9	2.07
Crude oil, 40 to 44.9	1.90

*Imperial Oil, Ltd. †Imperial Oil, Ltd., and Regal Oil & Refining Co.

Mexico

Panuco*	$.70

*F.o.b. ship, based on March transactions and exclusive of production and export taxes and bar dues.

California Crude Oil Prices

STANDARD OIL CO OF CALIFORNIA

(Effective September 6, 1933)

For current purchases of crude oil at the well (unless otherwise specified). (All gravities above those quoted take highest price offered in that field.)

Gravity—offered in that field.)	Long Beach	Seal Beach, Alamitos Heights	Huntington Beach	Inglewood	Playa del Rey	Olinda, Brea Canyon	Athens-Rosecrans	Torrance	Richfield	Whittier, La Habra	Montebello	Santa Fe Springs	La Habra-Coyote	Midway-Sunset, Elk Hills, Buena Vista Hills	Lost Hills	Coalinga	Coyote
14-14.9	$.65	$.65	$.65	$.65	$.65	$.65	....	$.65	$.65	$.65	$.65	....	$.65	$.57	$.57	$.57	$.65
15-15.9	.65	.65	.69	.69	.66	.69	....	.66	.65	.65	.65	....	.65	....	....	....	.65
16-16.9	.66	.65	.72	.73	.69	.73	....	.69	.67	.68	.65	....	.65	....	....	....	.65
17-17.9	.69	.65	.75	.76	.73	.76	....	.72	.70	.71	.65	....	.68	....	....	....	.68
18-18.9	.72	.65	.78	.80	.76	.79	....	.75	.74	.74	.65	....	.71	.61	.61	.59	.71
19-19.9	.75	.65	.81	.83	.80	.82	....	.78	.78	.78	.65	....	.74	.64	.65	.62	.74
20-20.9	.78	.68	.83	.87	.83	.85	....	.81	.82	.81	.66	....	.78	.67	.69	.65	.78
21.21-9	.81	.72	.86	.90	.87	.88	....	.83	.85	.84	.69	$.72	.81	.70	.73	.68	.81
22-22.9	.84	.76	.89	.94	.90	.92	....	.85	.89	.87	.72	.76	.84	.73	.76	.72	.84
23-23.9	.88	.81	.92	.97	.94	.95	$.83	.89	.93	.90	.76	.79	.87	.77	.79	.75	.87
24-24.9	.91	.85	.95	1.01	.97	.98	.86	.92	.97	.93	.80	.83	.90	.81	.82	.78	.90
25-25.9	.94	.89	.98	....	1.00	1.01	.90	.95	1.00	....	.85	.87	.92	.85	.85	.81	.93
26-26.9	.97	.93	1.01	....	1 04	1.04	.94	.98	1.04	....	.99	.90	.96	.89	.88	....	.96
27-27.9	1.00	.98	1.04	....	....	1.07	.97	....	1.08	....	....	.94	.99	.93	.91	....	.99
28-28.9	1.03	1.02	1.07	....	....	1.10	1.01	....	1.11	....	....	.98	1.02	.97	.94	....	1.02
29-29.9	1.06	1.05	1.09	....	....	....	1.04	....	1.15	....	....	1.01	1.05	1.01	.97	....	1.05
30-30.9	1.09	1.10	1.12	....	....	....	1.08	....	....	....	....	1.05	1.09	1.05	1.00	....	1.09
31-31.9	....	....	....	....	....	....	1.12	....	....	....	....	1.08	1.12	1.09	....	....	1.12
32-32.9	....	....	....	....	....	....	1.15	....	....	....	....	1.12	1.15	1.13	....	....	1.15
33-33.9	....	....	....	....	....	....	....	....	....	....	....	1.16	1.18	1.17	....	....	1.18
34-34.9	....	....	....	....	....	....	....	....	....	....	....	1.19	1.21	....	....	....	1 21
35-35.9	....	....	....	....	....	....	....	....	....	....	....	1.23	....	....	....	....	....
36-36.9	....	....	....	....	....	....	....	....	....	....	....	1.26	....	....	....	....	....
37-37.9	....	....	....	....	....	....	....	....	....	....	....	1.30	....	....	....	....	....
38-38.9	....	....	....	....	....	....	....	....	....	....	....	1.34	....	....	....	....	....

Additional Standard Oil Quotations

Elwood Terrace—F.o.b. ship, 32 degrees, $1.03; 34 degrees, $1.06; 35-35.9, $1.09; 36-36.9, $1.12; 37 degrees and over 1.15.

Newhall—14 degrees and over, 57 cents.

McKittrick and Kern River—14 degrees and over, 57 cents.

Wheeler Ridge—14 to 17.9 degrees, 57 cents; 18-18.9, 58 cents; 19-19.9, 61 cents; 20-20.9, 64 cents; 21-21.9, 67 cents; 22-22.9, 70 cents; 23-23.9, 73 cents; 24-24.9, 76 cents; 25 degrees and over, 79 cents.

Kettleman Hills—33-33.9 degrees, 93 cents; 34-34.9, 96 cents; 35-35.9, 99 cents; 36-36.9, $1.02; 37-37.9, $1.05; 38-38.9, $1.08; 39 degrees and over, $1.11.

The Texas Co. posted in Shiells Canyon, South Mountain and Santa Paula as follows: 14 to 17.9, 57 cents; 3 cents added for each degree up to and including 26-26.9 degrees at 84 cents; then 4 cents added for each degree up to and including 30 degrees and over at $1. Company posts Standard Oil Co.'s Montebello prices in Montebello and North Whittier, and posts Standard Oil Co. prices in Signal Hill, Alamitos Heights, Huntington Beach, Torrance, Richfield and Santa Fe Springs, all effective September 6.

General Petroleum Co. posts Standard Oil Co. prices in Athens, Rosecrans and Signal Hill; Alamitos Heights up to 26-26.9; Santa Fe Springs up to 35-35.9; Richfield up to 25-25.9; Brea Canyon and Olinda up to 25-25.9, and Torrance up to 25-25.9.

Union Oil Co., effective September 6, posts same price as Standard Oil Co. in all fields in which both purchase, excepting that in Athens-Rosecrans, Union Oil Co. posts 21-21.9, 72 cents, and 33-33.9, $1.18; 34-34.9, $1.21, and 35-35.9, $1.24.

Associated Oil Co., effective September 6, posted same prices for the same grades as Standard Oil Co. of California, excepting that in some fields its gravity scale stops as follows: Huntington Beach, 26 degrees and over; Seal Beach and Alamitos Heights, 26 degrees and over; Coyote Hills, 23 degrees and over; Richfield, 25 degrees and over; Torrance, 25 degrees and over; Inglewood, 24 degrees and over; Santa Fe Springs, 35 degrees and over; Midway-Sunset, Elk Hills, Buena Vista Hills, 30 degrees and over. Also Associated pays 52 cents for oil of 11 to 13.9 gravity in McKittrick, Kern Front, Kern River, Midway-Sunset, Elk Hills, Buena Vista Hills and Coalinga.

Great Lakes Pipe Line Is Being Looped Between Kansas City and Des Moines

The Great Lakes Pipe Line Co. is constructing several loops to its line between Kansas City and Des Moines. The loops will be of 8-inch A. O. Smith pipe and will be electrically welded. The purpose of looping the line is to reduce working pressures which have been around 800 pounds and which, it has been concluded, constitute an uneconomical operation. It has not as yet been determined how many loops will be constructed or the exact mileage involved, although the distance between the two cities is approximately 221 miles.

The loops being placed in the line will not increase the capacity as they are in the middle of the line and no additional stations will be constructed. The work is being done solely to correct an operating problem. While the construction is in progress it is possible a stand-by unit will be installed at Kansas City, which is a junction point on the line, although this has not yet been decided.

The Great Lakes Pipe Line Co.'s system, which transports gasoline, extends from Tulsa and Ponca City in Oklahoma to Kansas City, Des Moines, Council Bluffs and to Chicago and Minneapolis.

At present eight companies, all of which are interested as stockholders in the Great Lakes company, are using its transportation facilities. The names of the companies and the refineries to which the line is connected are as follows: Barnsdall Oil Co., Barnsdall and Okmulgee, Okla.; Continental Oil Co., Ponca City, Okla.; Mid-Continent Petroleum Corp., Tulsa, Okla.; Pure Oil Co., Muskogee, Okla.; Phillips Petroleum Co., Okmulgee, Okla.; Skelly Oil Co., Eldorado, Kans.; Sinclair Refining Co., Coffeyville, Kans., and Sand Springs, Okla., and the Texas Co., West Tulsa, Okla.

At the annual meeting of stockholders of the Great Lakes company held in New York last week the following directors were elected: Dan Moran, Continental Oil Co.; Jacob France, Mid-Continent Petroleum Corp.; E. B. Reeser, Barnsdall Oil Corp.; W. G. Skelly, Skelly Oil Co.; C. B. Watson, Pure Oil Co.; C. R. Musgrave, Phillips Petroleum Co.; E. W. Sinclair, Consolidated Oil Corp.; W. S. S. Rodgers, Texas Corp.; T. S. Lamont and Harry Moreland.

The following are officers of the company: Dan Moran, president; Harry Moreland, vice president and general manager; James J. Cosgrove, vice president; P. A. Ward, secretary and treasurer; W. L. Carroll, assistant secretary and assistant treasurer, and R. L. Bosworth, assistant secretary.

East Texas Meeting Demands Enactment of the Bill for Federal Oil Control

TYLER, Tex., May 8.—At the general meeting called here today by the Texas Petroleum Council, the oil committee of the East Texas Chamber of Commerce and others at which Carl Estes of Tyler made the keynote address, he termed Ernest Thompson, Railroad Commissioner as the No. 1 public enemy of the oil business because of his utterances against Federal intervention.

Resolutions were passed commending certain new rules of the commission as proper conservation and regulatory measures, especially Rule 37 and commending the commission on its new practice of hearing publicly all exceptions to the spacing rules in the order of April 3. The meeting also commended the commission for placing R. D. Parker in charge in the field and Mr. Parker for the work he had done and recommended no substitutions be made as long as he remain as active as during the past four weeks. It was also recommended that each operator in the field favoring conservation and orderly production more closely supervise his own property and report violations and co-operate in prosecuting violators.

The meeting further resolved "That this meeting heartily endorse the movement to obtain from the Congress of the United States at this time a law to provide for adequate Federal control and regulation of the oil industry at any and all times of emergency, and that the Congress be informed that in the opinion of those present in this meeting such an emergency now exists and without such Federal law, chaos in the oil industry and the inevitable calamitous results on all industries will result."

It was also resolved to boycott any pipe line, reclamation plant, refinery or handler or processor of crude oil who is guilty of violating conservation laws.

The Railroad Commission was commended for condemning and prohibiting split connections, and Attorney General Allred for vigorous work in prosecuting violations of commission orders.

It was brought out in the meeting that hot oil production was again increasing in the field due to violators feeling that Congress is too busy to get around to any action on the oil bill now and "taking aid and comfort" from Colonel Thompson's utterances against Federal control.

Rade Kangerga, landowner of Henderson, was chairman of the resolutions committee.

None of the commissioners attended the meeting and Attorney General Allred was busy prosecuting a violation case, preventing attendance. About 350 attended the meeting.

Committee Recommends Buying Surplus Gasoline

WASHINGTON, D. C., May 8.—The Planning and Coordination Committee today passed a resolution stating that quantities of gasoline in various localities do not find a proper market channel and that the committee is of the opinion that if certain established refining companies would undertake to supply a small part of their sales from refineries other than their own it would relieve some of the existing local unbalance.

The committee therefore made the recommendation that certain companies (including subsidiary and affiliated companies) purchase and receive in the territories in which they operate, in a reasonably uniform manner during the month of May, gasoline manufactured by refining companies not included in those agreeing to this proposal, in an amount not less than 3 per cent of the gasoline sold by these agreeing companies during the month.

It is the intent and purpose of this request that an outlet be provided for gasoline at those points where there is a surplus. Therefore the companies agreeing are urged to allocate purchases to make this purpose effective, in so far as their practical circumstances will permit. Agreeing companies are requested to report to the committee at the end of May, or as soon thereafter as possible, the quantities of gasoline which they have purchased pursuant to this request.

MORRIS WEISS DIES

CALGARY, Alberta, May 5.—Morris Weiss, well known in the oil business here, died recently, aged 43.

New World Drilling Record, First Well to 11,015 Feet

LOS ANGELES, Calif., May 7.—General Petroleum Corp., California subsidiary of Socony-Vacuum company, in addition to holding the existing world's record for drilling depth, has just come into possession of another distinction by drilling the first hole to reach 11,000 feet. The new record was established a few days ago in No. 1 Berry, a test in the South Belridge Field of Kern County where the company is making a determined attempt to prove or disprove the existence of Temblor and Eocene production.

The previous record holder was No. 1 Lillis Welsh of the North Kettleman Oil & Gas Co. in the North Dome of Kettleman Hills which was carried to 10,944 feet before mechanical trouble developed. General Petroleum exceeded this depth on April 7 and has subsequently gone to its present depth of 11,015 feet. No. 1 Berry has shown indications of substantial gas pressure from time to time but the possibility of developing commercial oil production remains to be seen.

Late Fields

OKLAHOMA

Carter Oil Co.'s No. 1, C NE NW Section 29-20-2w, in the Lucien Field in Noble County, but outside the communitized block, was drilled deeper and produced 2,233 bbls. in six and one-half hours, or at the rate of 8,245 bbls. per day. Second Wilcox sand was penetrated from 5,035-5,140 feet. The well was then put on a potential test.

West Oak Gas Co.'s wildcat test in Beckham County, in the southwestern part of the State, No. 1 Powell, NW SW SW Section 11-9n-25w, uncovered a 12,000,000-foot gas production with a showing of oil from dolomite at 3,488 feet, total depth.

Ward County Completion Methods Used Offer Suggestions to Other Operators

Production men in different areas may benefit from a description of production methods used by one company in Ward County, Texas. An outline of surface conditions and present casing programs will aid in getting a better idea of conditions encountered.

Approximately 900 feet of 10¾-inch casing is set at about 900 feet, sufficient cement being used to reach the surface, protecting the surface water. The formations above 900 feet, predominantly red sand and red shale, are drilled with drag bit, circulating mud.

Under the original program approximately 2,160 feet of 7-inch casing was set and cemented at 2,160 feet with 260 sacks of cement, sufficient to bring the cement above a corrosive water zone at 1,000 feet. In later wells it has become common practice to set the 7-inch casing at about 2,343 feet, which is through the dry gas zone, and cement with 260 sacks of cement.

The formations from 900 to 2,160 feet consist of anyhdrite and salt and have thin streaks of sand and lime. As there are no caving formations encountered, clear water is used as a circulating fluid. Cavities often encountered in this section in the past caused a great deal of trouble and expense due to difficulty in mudding them off. However, a "balance" cement job, using Aquagel with the cement, was successful in cementing off the cavity in the latest well drilled. This is believed to be an economical and rapid method of sealing off the cavities in this area.

Drilling below the 7-inch casing is carried on using 3½-inch O.D., flush joint drill pipe.

Methods Employed

Before the cement is drilled, a master gate and blowout preventer are put on the 7-inch casing. A 6¼-inch hole is drilled from 2,160 to 2,220 feet at which point an old type (probably now obsolete) Sheldon-Burton stuffing box is put immediatley above the blowout preventer. A tubing snubber, known to the drilling crew as a "whiffletree," is slipped over the 3-inch flush joint drill pipe and held in place by 1-inch studs. Posts set in the rotary table hold this tubing snubber and turn the drill pipe. This allows 2 feet of hole to be drilled before it is necessary to loosen the studs and raise the snubber up 2 feet. Loosening the studs, raising the snubber and retightening takes the crew from 1 to 1½ minutes.

While drilling through the dry gas sands from 2,230 to 2,300 feet, clear water is used as circulating fluid. The water and gas returns go through a gas trap, the gas is blown to the air and the water returned to the mud pit.

Oil is usually encountered in sands between 2,460 and 2,520 feet. After oil is encountered, the pits are jetted out until the circulating fluid is practically all oil. During the time the well is drilling in, about 80 pounds pressure is held on the trap. It is often necessary to tighten the stuffing box head to prevent leakage. However, the operation does not take over five minutes.

When it is necessary to change bits, the pipe is raised until the bit is between the master gate and the stuffing box, the master gate is then closed, the stuffing box loosened and removed, coming up with the bit. After the bit has been changed, the reverse process is followed, going back into the hole.

Sand Enlarges Hole

The equipment used in drilling in wells by this method, while not entirely satisfactory from a conservation standpoint, is a very effective method of completing wells without allowing heavy mud to come into contact with the producing sands. The method also has another advantage: After the well is completed, the drill pipe can be raised about 400 feet from the bottom, the pumps shut down and all of the circulating fluid blown from the hole. The blowout preventer is then closed and the well allowed to build up its maximum pressure. The pressure released then causes large quantities of sand from the producing zones to come into the hole, causing the hole to bridge. The bridge is then closed out to bottom with the drill pipe.

From calculations of the amount of sand that comes into the hole to form the bridge, it is estimated the average size of the hole is increased from 6¼ inches to 13 inches, which of course gives a greater diameter well and consequently larger potential. The producing sands in this area are lenticular and show no evidence of edge or bottom water, so there is no dangre of hastening the encroachment of edge water.

Of advantage to the operator is the fact that while the well is drilling in, the gas and oil are flowing against not over 80 pounds pressure. This tends to open and extend drainage channels which would not be the case if the well were drilled in with a hole full of mud.

The main disadvantage of this method is the waste of gas during drilling in. An average well takes approximately 60 hours to drill through the gas and oil sands. During that time varying amounts of gas are blown to the air and about 600 bbls. of oil produced into the pit, which has to be cleaned before selling to the pipe line.

Find Gas Field in Andrews County, West Texas; Wildcats in Ector County Closely Watched

By L. E. BREDBERG
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., May 7.—A gas field was assured the West Texas district during the week when Humble Oil & Refining Co.'s No. 1 Means, a wildcat in Andrews County, gauged 10,800,000 feet of gas at the bottom of the Yates sand at 2,957 feet. Tools were blown up the hole, causing a difficult fishing job and it is reported the well will be completed as a gas well and another test is to be started in the area, probably with heavier equipment to drill through the gas pay. This is the second time the tools have been shoved up the hole by gas, the first time at 2,572 feet.

The showing of this test, which is in Section 2, Block A-35, Public School Land Survey, has caused one of the most active lease and royalty buying campaigns this district has witnessed in some time. Due north of the Means test and in Gaines County, Devonian Oil Co., Honolulu Oil Co. and several others have been purchasing acreage between Gill and others' No. 1 Crews, a dry hole in Section 9, Block A-20, and the Westheimer dry hole in League 308, Terrell County School Lands, in Gaines County. In Andrews County Humble Oil & Refining Co. continues to purchase acreage centering around Block C-45, Public School Land Survey. Shell Petroleum Corp. is also active in this area. Royalty under the Means ranch is reported to be selling from $40 to $75 per acre base.

Ector County

In northwest Ector County, C. J. Davidson's No. 1 Cummins, a wildcat in Section 10, Block 45, Township 1n, T.&P. Survey, had another showing of gas at 2,905 feet and is drilling below 3,425 feet. It is showing an estimated 1,250,000 feet encountered at 2,740 feet. It is credited as running 140 feet higher structurally than the nearest dry hole. Another wildcat being watched with much interest is Honolulu Oil Co.'s No. 1 Kloh, 3 miles southwest of Broderick and Calvert's No. 1 Cowden, a producer, and in Section 33, Block 44, Township 2s, T.&P. Survey. It continues to check about 130 feet higher on the lime section than the Cowden producer, and is credited with having offered traces of oil in the brown lime topped at 3,643 feet. It is drilling below 3,933 feet.

In the northeast flank of the Addis Pool, Ector County, Stanolind Oil & Gas Co. is completing No. 1 E. F. Cowden in Section 26, Block 43, Township 2s, T.&P. Survey. It began filling with oil at 3,950 feet and cleaned itself after getting an increase in oil at 3,065 feet. It is heading every seven hours while drilling below 4,011 feet.

Pecos County

Humble Oil & Refining Co.'s No. 1 J. L. Nutt, 12 miles southwest of the Taylor-Link Pool, in Pecos County, attracted attention when it started spraying 65 bbls. of cut oil after being plugged back from 2,405 feet to 2,397 feet. It was being prepared for abandonment after striking sulphur water at 2,405 feet. The oil which showed up in about 100 bbls. of fluid did not exceed 25 per cent and it is believed production is not likely. It is in Section 16, Block 125, T.&St.L. Survey.

Crane County

In Crane County, 6 miles due west of the Church & Fields Pool, George McCamey of Fort Worth is reported to be on a deal to drill in Section 13, Block X, C.C.S.D. Survey, a wildcat. Gulf Production Co.'s No. 1-D Edwards in Section 21, Block B-18, P.S.L. Survey, has recovered tools lost in the hole at 4,780 feet and is preparing to drill.

Loving County

Texas Pacific Coal & Oil Co.'s No. 1 Rex., an interesting wildcat in Loving County, is being abandoned at a total depth of 4,572 feet in sand. A small show of oil and three-fourths bailer of water was encountered at 4,560 feet, which increased to 1¼ bailers per hour at 4,572 feet. It is in Section 40, Block 54, Township 1, T.&P. Survey.

Ward County

Two producers were completed in Ward County. Jack Leidecker's No. 2 Archenhold in Section 23, Block 5, H.&T.C. Survey, flowed 439 bbls. in 24 hours through casing after being shot. It was completed at a total depth of 3,088 feet. Atlantic Oil Producing Co.'s No. 16 Johnson flowed 256 bbls. in 24 hours through tapered tubing from a total depth of 2,531 feet. It is in Section 9, Block 34, H.&T.C. Survey. In the same county, Tex-Mex Oil Co.'s No. 2 Llano-Sloan is nearing completion. It flowed 288 bbls. of oil in 24 hours and is preparing to plug off a small amount of water. It is bottomed at 3,088 feet.

Fisher County

In Fisher County, Roeser and Pendleton's No. 2 Steele topped the pay at 2,182 feet and at 2,196 feet it swabbed 800 bbls. of oil and 200 bbls. of water in 24 hours. It is in Section 210, Block 1, B.B.B.&C. Survey, in the northeastern corner of the county.

Runnels County

On the southwest side of the McMillan Pool, Runnels County, Agnew Oil Co.'s No. 3 H. B. Fowler is reported to be abandoning. It encountered a hole full of salt water at 2,549 feet after getting a showing of oil at 2,543 feet. It is in Subdivision 23, Norvell Travis Survey No. 533. Three tests were spudded in the pool last week. The next test to reach the pay horizon is expected to be Prairie Oil & Gas Co.'s No. 1 T. B. Wade, in Subdivision 10, Norvell Travis Survey. This is a small company operating out of San Angelo.

Jones County

The Condor-Sayles area in Jones County was extended a short distance when Texas Inland Oil Co.'s No. 1 Sellars, in W. Delk Survey No. 241, topped the pay at 1,748 feet and filled 1,050 feet with oil in five hours. It is estimated good for 40 bbls. of oil daily. This area is south of the town of Hawley. Only two wells have been drilled in the pool.

In the Howard County area, Humble Oil & Refining Co.'s No. 2 Settles was completed at 2,428 feet pumping at the rate of 520 bbls. daily 40 per cent of which was water. It is in Section 132, Block 29, W.N.W. Survey. In the same area, Sinclair Prairie Oil Co.'s No. 10 Dodge in Section 11, Block 30, Township 1s, T.&P. Survey, pumped 50 bbls. upon completion at a total depth of 2,808 feet.

Humble Oil & Refining Co. is trying to unitize a large block of acreage, three sections of which are in G.C.&S.F. Survey and five sections in the H.E.&W.T. Survey, and a proposed 9,000-foot test is tentatively located in Section 36, H.E. &W.T. Survey. Shell Petroleum Corp., Gulf Production Co., Continental Oil Co., Stanolind Oil & Gas Co., Empire Gas & Fuel Co., Sun Oil Co. and others have acreage in this immediate vicinity and may come in with Humble Oil & Refining Co. on drilling an Ordovician test, which should be an extremely interesting one.

Edwards County

H. H. Sides of McCamey is moving in a machine in Section 164, C.C.S.D. & R.G.N.G. Survey, to drill a 1,000-foot test in Edwards County. This test is being drilled on the basis of oil showings found in wells drilled for water in the area. The location is on the Paul Turney ranch. Another test on the same ranch is to be drilled by N. G. House of Alpine. This is about 1½ miles northeast of the above location. These two tests will be the first in the county in some time.

WICHITA FALLS

The exceptionally good well brought in last week by R. W. Busby and associates on the J. L. Anderson ranch in Block 18, South Anderson Ranch, north of the Swastika Pool and north of Olney in Archer County, has created another drilling rush in this area which is being redrilled for lime production which is enhanced by acid treatment. During the week six tests were either being put down or being prepared for drilling around the Busby 2,000-bbl. initial producer, and other tests were slated in the vicinity. The Falls County School Lands has been the scene of heavy drilling during the past few months since lime treatment has proven effective.

Golding and Cochran completed another big producer this week when its No. 1 J. L. Anderson in Block 19, S.P.R.R. Survey, made an initial production of 1,200 bbls. from lime logged at 1,344-61 feet. It was treated with 1,500 gallons of acid.

The Wichita Falls district and the city of Wichita Falls is having what may be termed an "acid boom" because acid treating has caused activities to increase so greatly. Areas once condemned because tests failed to pick up production are now receiving a play as if dry holes did not exist. Ranches in the Archer County lime areas are strewn with drilling equipment debris, signs of former drilling and a previous boom, and new rigs are now being moved in among the gravestones of former discouraging abandonments.

In the northeast quarter of Young County, 5 miles north of the James Pool, Associated Developers Co.'s No. 1 Sparks (Brazelton), in Section 286, T.E.&L. Survey, is drilling below 4,250 feet. It is to be plugged back to the upper showing in lime and shot and treated. It now flows around 25 bbls. per day from sand logged at 2,957-67 feet which was bradenheaded. The James Pool to the south is showing an appreciable decline in production, the wells not holding up as expected.

Production in the district averaged 60,255 bbls. during the week.

PANHANDLE

Activity in the Panhandle district picked up considerably. Twenty-two wells were completed and 19 new locations were made, mostly in the eastern part of Gray County and the western part of Wheeler County. The majority of the wells completed were in Gray County, 17 being reported, the other completions being in Hutchinson, Moore and Wheeler Counties.

In Gray County one of the largest wells completed for some time was Wilcox Oil & Gas Co.'s No. 26 Combs, Section 35, Block 3, I.&G.N. Survey. First gas was encountered at 2,890 feet and it started flowing at the rate of 90 bbls. per hour while drilling to 2,908 feet. It is showing an estimated 15,000,000 feet of gas.

One wildcat was made in Collingsworth County, in Section 16, Block 13, H.&G.N. Survey, and is to be carried as J. M. Rayhill's No. 1 G. Bell.

Shamrock Oil & Gas Co.'s No. 1 Ruppert, in Section 191, Block 3, T.&N.O.

(Continued on Page 168)

Wildcat Operations in West Texas

Week Ending May 7

ANDREWS COUNTY

Company, well, farm name, section and block—	Remarks:
Fuhrman Pet. Co.'s No. 1-B Bonner, 1,320 ft. from N line and 1,320 ft. from E line of Sec. 35, Blk. A-43, P.S.L. Sur.	S.D. 3,964 ft.
Humble Oil & Ref. Co.'s No. 1 R. M. Means, 660 ft. from N and 660 ft. from E of Sec. 2, Blk. 2-35, P.S.L. Sur.	Gauged 10,800,000 ft. of gas; T.D. 2,957 ft.
Humble Oil & Ref. Co.'s No. 1 Kuykendall, 1,980 ft. from S and E lines of Sec. 24, Blk. A-46, P.S.L. Sur.	Drlg. 4,015 ft.
Llano Oil Co.'s No. 1 J. E. Parker, 330 ft. from N line, 990 ft. from E line of Sec. 18, Blk. A-44, P.S.L. Sur.	Location.

BORDEN COUNTY

Continental Oil Co.'s No. 1 Johnson, 660 ft. from S line and 660 ft. from E line of Sec. 34, Blk. 32, Twp. 4n, T.&P. Sur.	Location.

BREWSTER COUNTY

Joiner-McIntyre's No. 1, 853 ft. from S, 2,390 ft. from E of Sec. 31, Blk. 352, W. M. Mitchell Sur.	S.D. 1,450 ft.

COKE COUNTY

Wm. Hooper's No. 1 Gaston, 240 ft. from S line and 554 ft. from W line of Joseph Sur. No. 11	S.D. 1,365 ft.

CRANE COUNTY

Gulf Prod. Co.'s No. 1 Edwards, 330 ft. from S line and 330 ft. from E line of Sec. 21, Blk. B-18, Public School Land Sur.	T.D. 4,780 ft.; recovered tools.
Wahlenmaier Petroleum Corp.'s No. 1 W. P. Edwards, 330 ft. from N and 330 ft. from E of SW cor. of the NE of Sec. 12, Blk. B-23, P.S.L. Sur.	Drlg. 2,965 ft.

CROCKETT COUNTY

J. D. Young's No. 1 Shannon, 330 ft. from W line, 330 ft. from N line of Sec. 35, Blk. 1, G.C.&S.F. Sur.	S.D. 2,635 ft.

CULBERSON COUNTY

Miller Bros.' No. 1 fee, 1,980 ft. from N and 660 ft. from E line of Sec. 21, Blk. 97, P.S.L. Sur.	S.D. 1,065 ft.

DAWSON COUNTY

Ray Albaugh et al's No. 1 John Robinson, 1,320 ft. from N line, 1,320 ft. from W line of Sec. 46, Blk. M, E.L.R.R. Sur.	Cleaning out 1,750 ft.

ECTOR COUNTY

Atlantic Oil & Prod. Co.'s No. 2 Holt, 660 ft. from N line and 1,980 ft. from E line of Sec. 19, Blk. A, P.S.L. Sur.	Location.

(Continued on Page 170)

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NEWS FOR PETROLEUM REFINERS

Middlesex Refining Co. to Start Plant About June 1

NEW YORK, May 5.—The Middlesex Refining Co. is completing work in improving its refinery at New Brunswick, N. J., and expects to start operating the plant about June 1. The new equipment includes two bubble towers for stills which have not been operated for several years. The company is also installing a pipe still unit to lower the viscosity of its heavy oils. The refinery has a rated crude oil capacity of 5,000 bbls. daily.

An operating arrangement has been worked out with the Raritan Petroleum Corp., Newark, N. J., and the American Mineral Spirits Co. of New York City. The Raritan corporation will furnish the crude oil for the operation of the unit and has contracted with the Middlesex company to process the crude. The Raritan corporation last week announced a new issue of $500,000 of three-year, 6 per cent participating warrants, the funds for which will be used in financing the project. As security for these warrants in addition to the cash to be held by the trustee, the company will deposit with the trustee 6 per cent first mortgage bonds of the Middlesex Refining Co. of New Jersey maturing February 1, 1943, to the extent of 50 per cent of the face value of the warrants as sold up to a total of $200,000. Louis H. Bean is president of the Raritan corporation.

The American Mineral Spirits Corp. has contracted to purchase the entire output of the plant. The Middlesex company has offices at 60 East Forty-second Street, New York. Thomas Graham is vice president of the company and Louis H. Bean secretary. W. Leigemann is superintendent of the refinery.

OKLAHOMA A.C.S. MEETING

The Oklahoma section, American Chemical Society, is meeting in Tulsa on May 12, the opening day of the International Petroleum Exposition. The section will convene at the Sinclair Pennant Tavern at 6 p.m. Following dinner and entertainment, Dr. W. A. Gruse of the Mellon Institute will address the meeting on the subject: "The Chemical Constitution of Petroleum."

The meeting is open to all visiting petroleum technologists. Reservation should be mailed to J. R. Marshall, Mid-Continent Petroleum Corp., West Tulsa,, Okla.

ENGINEERS HEAR MURPHY

CHICAGO, May 5.—George B. Murphy, manager of the research and development laboratories of the Universal Oil Products Co. Chicago, addressed the Armour section of the American Institute of Chemical Engineers at Armour Institute of Technology, Friday, May 4. His subject was: "Application of Chemical Engineering Principles to the Manufacture of Antiknock Gasoline."

GAS FOR OCTANE PLANT

Ten miles of 3-inch line will be laid by Hoffman and Page from the shallow gas field near Pueblo in Callahan County, Texas, to the Octane Refining Co. plant at Chautauqua Switch. The line will supply gas to the refinery as fuel.

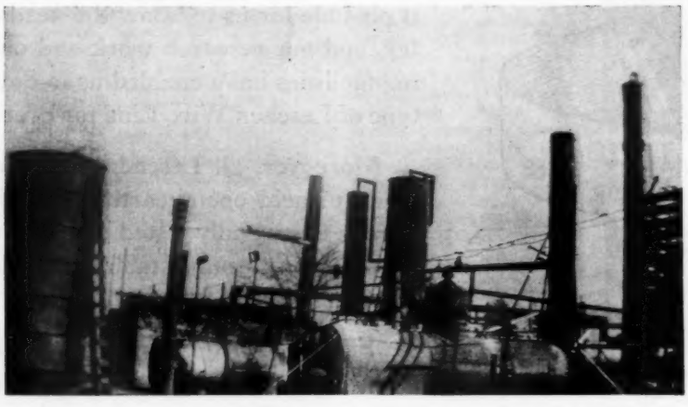
REMOVE SULPHUR

SARNIA, Ontario, May 5.—Dr. R. K. Stratford and William P. Doohan, of Sarnia, have secured a United States patent for a new method of freeing oils from sulphur dioxide. The patent has been assigned to the Standard Oil Development Co.

Simplest Type of Distillation Unit May Be Seen in East Texas Refining Area

By RALPH GOODE

Petroleum refining in East Texas reaches down to the simplest form of distilling equipment in many of the operating plants in the field but there are also a number of modern refineries at Tyler, Overton, Kilgore, Longview and Gladewater. The boiler-type of refinery is common. Using oil field type boilers as stills, they are connected from the dome to a flash or bubble tower the gases going from there to aerial type condensers made of 2-inch pipe coils cooled by a water spray falling downward to a pit where the water is picked up again. The boiler-stills are charged into the side about middle way up. Usually the top row of flues is removed from the boiler and the ends of the boiler are welded closed so a high level of charging stock will not have to be held in the still.



One of the "boiler still" refineries located in the East Texas field

No provision is made for steam to enter the still. A high charging rate is maintained to prevent local overheating and cracking and hence coking of the boiler-still. Two 3-inch pump-out lines are placed at the bottom of the boiler at the blow down level for removing the fuel oil (topped crude). A liquid level gauge glass is used for determining the level of oil in the still and a pressure gauge is on the vapor line to the fractionating tower. The boiler-still is set as high as possible and a 24-inch pit is dug into which the firing is done directly under the fire box. Combustion is carried on by use of a 12-inch nipple placed at an angle downward into the pit.

According to the engineers in charge of plants of this type a 66-horsepower Oilwell boiler-still will handle a throughput of 1,000 bbls. of 36.8 A.P.I. gravity East Texas crude every 24 hours. Steam is furnished for pumping by two 45-horsepower boilers. A typical run with this type of refinery produced the following products:

TYPICAL YIELDS

Gasoline, 437° e.p.	30.0%
Kerosene, 575° e.p.	7.0%
Gas oil, 34/36 gr.	13.0%
Fuel oil 26/28 gr.	47.0%
Refining loss	3.0%
Total	100.0%

The gasoline and kerosene are separated beyond the flash tower and the gas oil is removed from the flash tower. Where no flash tower is used the gas oil is removed from the bottom of the fractionating tower. Most of the plants do not produce a gas oil. Quite a number do not produce any product except gasoline. They top the crude at a temperature of about 300° F. and sell the residue in tank cars. Practically all of the refineries use some sort of bubble tower realizing their value over that of packed metal towers. The very low sulphur content in East Texas crude produces distillates that are sweet and the gasoline and kerosene meet the copper strip corrosion test without chemical treatment, hence there are no heating costs.

Refinery operating costs per barrel of crude are abnormally low in such a plant and a high liquid and gas loss of little concern. An East Texas refinery built along these lines operates with the following visible personnel list of one guard and three combined stillmen-boiler firemen-pumper-loader, office-man and superintendent.

At low prices there is a ready market for the products. Tank trucks transport most of the gasoline and kerosene from the plant to market and drilling rigs in the field use most of the fuel oil. Cost of constructing the average plant of the above description is of course low. Used boilers are often purchased for as little as $75 to $100 each and used pumps cost as little as $10 to $15 each. The rest of the equipment consisting of 2 to 6-inch pipe, the towers and tankage can be bought at nominal prices from second-hand dealers and from dismantled plants outside the field. A good welder is the principal requisite in construction and often receives $4 per hour. A plant of this type costs about $1,500.

Modern Plant

The modern refineries in East Texas are producing high octane gasoline, kerosene of high burning quality and straight-run distillates that are exceptionally good in color, odor and burning properties. Among these plants may be found experienced refinery men and equipment that is of the latest design. With this mixture of plant types it is impossible to refer to East Texas refineries without differentiating between the "improvised" and the "permanent."

Many Items Went Into Shell Advertising Plan

The Shell Petroleum Corp.'s advertising program, launched last week to introduce a new "Super Charged" Super Shell gasoline, was a boon to many industries, as revealed in a statement issued by L. van Eeghen, vice president in charge of marketing.

"To round out our advertising program, which includes large display space in 334 newspapers, radio broadcasts from 21 stations, and outdoor posters in 874 cities and towns throughout the territory, Shell placed the largest order on record for outdoor cut-out figures, which feature our decorations at 13,000 service stations," Mr. van Eeghen declared. "These decorations include brightly colored 2-foot carboard and 8-foot fiber board figures of the famous comic strip characters, Mutt, Jeff, Powerful Katrinka and the Toonerville Skipper, together with flags, window stickers, and hoods for station pump globes.

"At one factory alone the Shell order gave jobs to 504 unemployed workmen. Six hundred twenty men were employed in the two plants of an Ohio firm which handled the printing, mounting and die-cutting of the mammoth cutouts. An extra factory was leased to provide the necessary working space.

"Practically all the materials used were made expressly to fill the Shell order, and the raw material suppliers worked to capacity to meet the schedule, giving employment to hundreds of men and women. Nearly 700 tons of materials moved into Ohio by rail and truck from points as far away as Maine.

"A total of 10,666,000 bolts, strips, cleats and eyelets and other small pieces were used in the manufacture of the cut-outs. The wire, thread and cord used would reach from St. Louis to San Francisco. Over 3,000 gallons of paint and 4,500 pounds of ink were used.

CUSHING ADDS CRACKING UNIT

The Cushing Refining & Gasoline Co. will add a 2,000-bbl. cracking and reforming unit to its plant at Cushing, Okla., clearing of the ground having been completed and actual construction work is to start immediately. The design of the unit and all construction work will be handled by the refining company except heating will be accomplished by an Alcorn furnace. Construction is expected to be completed by September 1.

Over the past the company has operated as a skimming plant and the new unit will round out the operations of the 4,500-bbl. refinery to supply gasoline of high antiknock value.

COMBINATION UNIT FOR E. TEXAS

James C. Francis, formerly in the refining department of the Humble Oil & Refining Co., heads a group of local men who will organize a company with plans to build a 2,000-bbl. combination skimming and cracking unit in the East Texas Field.

TRINITY CRACKING UNIT

The Trinity Refining Co. has started construction on a 1,000-bbl. cracking unit at its Gladewater refinery in the East Texas Field. The plant was designed by the company. It will be in operation within two months.

TRIO COMPLETES CRACKER

The Trio Refining Co., a subsidiary of Oil Refineries, Inc., has just completed a 1,000-bbl. cracking unit at its plant near Arp, in the East Texas Field.

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"Fulscope" has all the Taylor advantages you know plus *eight* new major improvements! Any one of them deserves headlines. This "Universal Sensitivity Adjuster" alone justifies replacing your present regulators with Taylor "Fulscopes."

By means of this simple dial adjustment you can *exactly* match the throttling range with the time lag and heat capacity of the apparatus under control—quickly obtain the *highest possible sensitivity* without introducing valve "hunting" action.

Improved setting point adjustment makes settings easier—more accurate. Direct to reverse action is now obtained by simply changing the position of one part. A new type linkage and full length pen arm give feather touch—reduce drag to the absolute minimum. It disappears entirely for intermediate and low points. Improved bearings and a lighter leverage system practically eliminate friction, yet the new "Fulscope" mechanism is even more rugged.

Easy as tuning in a radio program*—The "Universal Sensitivity Adjuster" provides an *infinite* number of sensitivity values—enables you to obtain the *one best* for a particular process, *while the instrument is in operation.

Fluctuations in air pressure are completely compensated for in this modern instrument. Tube systems are easily replaced on the job—with a minimum of adjustments. The beautiful die-cast aluminum case—dust-, moisture-, and fume-proof—is available with either face or flush mounting.

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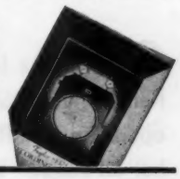
Every plant executive should have a copy of the new Taylor booklet, "A Triumph of Scientific Research" which gives a complete description of this remarkable instrument. Address Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.



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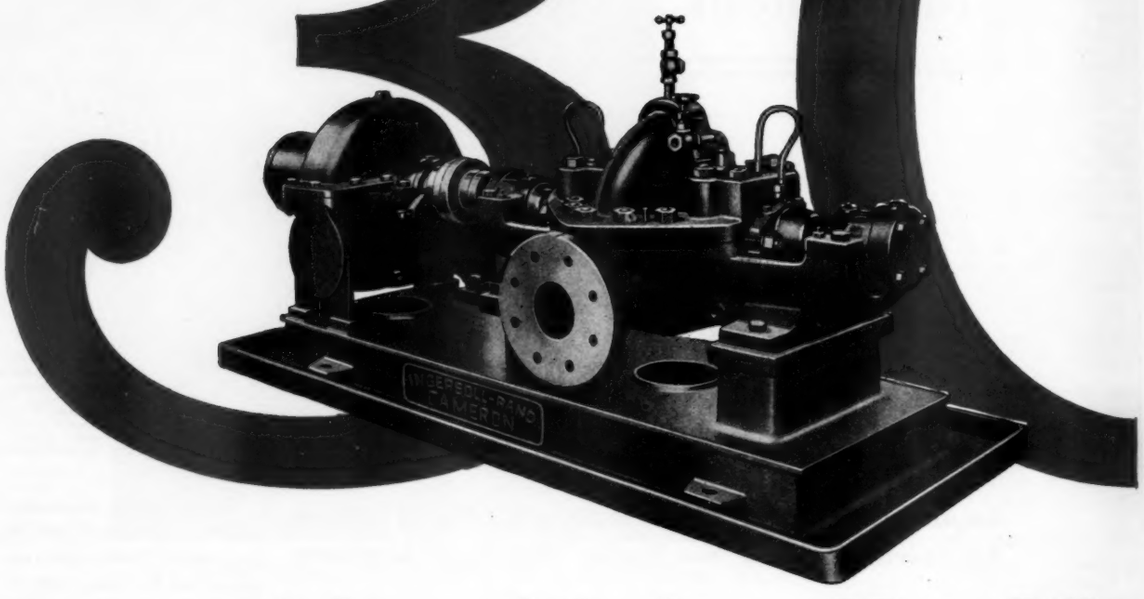

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OVER three hundred Cameron Hot-Oil and Reflux Pumps are already in successful daily operation, handling high temperature distillates, hot-oil transfer, stabil izer reflux, etc.

One Mid-Western refinery is operating over thirty-five of these Cameron BJV pumps; while a large Eastern refinery has twenty-five on which they depend for their daily production.

The Cameron Hot-Oil and Reflux Pump is backed by the experience of Cameron engineers who have been in constant touch with refinery problems since the inception of modern refining methods.

As dependable operation of this pump is the first consideration, all necessary refinements have been incorporated in its design to insure twenty-four hours pumping service per day.

Pumps in Refinery Service

DEPENDABLE operation is assured by: Liberal suction areas correctly proportioned for handling liquids at or near their point of vapor pressure • • • Vented suction passages • • • Extra deep, water-cooled stuffing boxes • • • Smothering-type glands • • • Special supporting feet, designed to compensate for expansion, located on coldest portion of casing • • • Large anti-friction, heavy-duty ball bearings • • • •

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Derivation of Equivalent Length Formulae for Multiple Parallel Oil Pipe Line Systems

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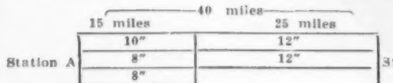
Pipe lines are laid often as a system of multiple parallel lines of different diameters. This condition applies particularly to the trunk line systems of the oil pipe line companies, which have been increased in capacity over a period of years by the addition of parallel lines of various diameters. These parallel lines are commonly known in the oil pipe line industry as "loops," and for the sake of brevity this term will be used in this paper to describe a parallel line.

The older pipe lines have in their trunk line systems some 6-inch pipe, but much of it is composed of parallel 8-inch lines on the high pressure end. The trunk pipe lines built more recently are composed of 10 or 12-inch pipe and in some cases a single 12-inch line rather than a multiple system of 8-inch lines. A single 12-inch line is nearly equivalent to three parallel 8-inch lines. One can easily understand the advantage of having the capacity of the system in the single 12-inch line rather than in the three parallel 8-inch lines.

The reason for the use of the smaller diameters of pipe in the older pipe-line systems was that it was felt safe to operate only the 6 and 8-inch lap welded pipe at such pressures as 600 to 700 pounds which is a normal operating pressure of oil pipe line pumping stations. Consequently, 8-inch pipe was usually used on the high pressure or pumping end of trunk line systems; and the 12-inch pipe was used on the low pressure ends. Seamless pipe of higher tensile strength came into use for oil pipe lines about 1926, and electrically welded (longitudinal seams) pipe somewhat later. The use of seamless or electrically welded pipe of higher tensile strength steel and welding for the girth joints brought about the extensive use of the larger diameters at the higher operating pressures. Such a system as has been described is shown diagramatically below:



The problem of calculating the length and diameter of an additional loop for such a system to obtain a desired capacity or to calculate the new operating pressures and capacities with the addition of a loop of a given length and diameter, becomes very complex and impractical if one tries to follow the formulas for parallel lines found in many of the text books on hydraulics. It must be kept in mind also that this problem concerns the hydraulics of fluids which have a wide variance in viscosities and densities.

To facilitate the solution and meet the complexity of the problem, it has been a common practice of the oil pipe line engineers to reduce a system of multiple lines to the equivalent length of a single line of a chosen diameter. To explain further what is meant by equivalent length: It can be demonstrated that three 8-inch (7.981 inches inside diameter) parallel lines of a certain length are equivalent in friction loss or capacity to a single 12-inch line (12.0 inches inside diameter) of a length which is 1.022 times the length of the three parallel 8-inch lines. Similarly four 8-inch lines would have an equivalent length factor of 0.62, converting to a single 12-inch line. Two eights and a single 10-inch (10.02 inches inside diameter) converted as parallel lines to a 12-inch would have an equivalent length factor, 0.66. Likewise three 8-inch parallel lines would have an equivalent length factor 0.4352 when converted to a single 10-inch line. All of this means that if the same amount of oil passing through the parallel lines were put through the single line, the length of the single line of the conversion diameter to give the same operating conditions as in the parallel lines would be obtained by multiplying the length of the parallel lines between the pumping and delivery point by the conversion factor, usually known as the "equivalent length."

Some of the equivalent length factors which have been used assume that the coefficient of friction remains constant regardless of the diameter of the pipe, the velocity of the fluid or whether the flow is streamline or turbulent. This assumption is not correct and the use of such equivalent factors cannot be used safely in designing loops for oil pipe line systems. This paper offers the derivation of formulas which have been used with accuracy by the engineers of a large pipe line company to design many miles of pipe line loops during the past six years. The formulas were developed in 1928 by the author and C. M. Scott, who is now chief engineer of the Stanolind Pipe Line Co. They have not been published because it was felt desirable to prove their accuracy in practice first.

The paper will show the derivation of the formulas, give a table of equivalent length factors and demonstrate the use of the formulas and the table in some examples. This paper is offered with the hope that it might prove useful to those persons who do not have an opportunity to check their formulas against actual operating data and with the thought of submitting the formula to be checked by other pipe line engineers against their operating data.

*Prepared for meeting of A.S.M.E., Tulsa.

Formulas for Fluid Flow in Pipe Lines

The basic theory for the friction loss in the flow of oil through pipe lines will be found in an article "Fluid Flow and Friction in Pipe Lines," which was prepared by the author and published in The Oil and Gas Journal June 5, 1930. Hydraulic theory recognizes two types of flow in pipe lines; namely, streamline and turbulent flow. Reference to Figure 1, which was used also in the above mentioned article, shows the streamline and turbulent flow curves plotted from the data of Stanton and Pannell[1]. Experimental and operating data on pipe lines 4 inches in diameter and larger confirm the experimental data of Stanton and Pannell. For the sizes of pipe of 4 inches in diameter and larger the coefficient of friction in practice conforms with the Stanton and Pannell curves. The following formulas which were developed in the author's paper on "Fluid Flow and Friction in Pipe Lines" are based on the Stanton and Pannell data:

$$P = 1{,}500(Bu/D^4) \quad \text{[Streamline flow]} \qquad (1)$$

$$P = 0.5583f(B^2s/D^5) \quad \text{[Turbulent flow]} \qquad (2)$$

in which:

P = pounds per sq. in. per mile.
B = barrels (42 gallons) per hour.
u = absolute viscosity in English units (foot-pounds).
s = density pounds per cu. ft.
D = inside diameter in inches.
f = coefficient of friction.

These two equations will be used for deriving the formulas for determining the equivalent factors.

Empirical Formulas for the Value f

The pressure loss formula No. 1 for streamline flow can be used directly for deriving the equivalent formula for this type of flow, because the value of the friction is incorporated in the formula; but in order to make use of the turbulent flow formula for deriving the equivalent length formula, an empirical value for f must be derived and substituted in equation No. 2.

The empirical equation for f was obtained by plotting the Stanton and Pannell data on a double logarithmic scale (Figure 2) and drawing a median line through the points and determining the slope of the line or in this case, the slopes of the lines. It was found that a straight line with a tangent value of 0.265 was a good average for the experimental data up to the point 4.76 as the logarithmic value of the value 57,600 for the ratio dvs/u. In this ratio, d is the inside diameter in feet and v is velocity in feet per second.

This ratio $\frac{dvs}{u} = \frac{0.02381B}{D} \frac{s}{u}$, which expresses it in the same units used in Formulas No. 1 and 2. The data beyond the value 57,600 was not satisfied by the line with the slope value of 0.265 and consequently another average line was drawn through the other experimental points. The slope value of this line was 0.188.

The author does not know of any operating or practical data to corroborate the results of Stanton and Pannell above 57,600 for the ratio dvs/u, but their other data have been so reliable that it is believed these values should be accepted and therefore it will be necessary to give consideration to two different empirical values for f; one below and the other beyond 57,600 for the ratio dvs/u.

As a rule the multiple parallel pipe line systems can be converted to an equivalent length of single 12-inch pipe to give a value less than 57,600 for the ratio dvs/u; but there may be exceptions and in that case it would be necessary to use the equivalent length formula derived by using the empirical value of f above 57,600 for the ratio dvs/u. Twelve-inch pipe has been used so extensively in the oil pipe line industry that there are reliable data to substantiate the theoretical values for friction losses in pumping a variety of crude oils at different rates through this size of pipe; consequently the 12-inch pipe is used as the conversion diameter for reducing a multiple parallel system to a single line which will be an equivalent length of the multiple parallel system. To reduce large parallel systems to an equivalent length 12-inch is used rather than 10-inch or 8-inch to keep the value of the ratio dvs/u for the "equivalent length" line below 57,600, beyond which there is some uncertainty because the oil pipe line industry has no figures of their own for the larger values of dvs/u to support these data of Stanton and Pannell.

In the exceptional cases of parallel systems of oil pipe lines with capacities which would give a value greater than 57,600 for the ratio dvs/u if the system were reduced to a single "equivalent length" 12-inch line of the same capacity, it would be necessary to resort to the use of a formula for the equivalent length in which the slope 0.188 is used in the empirical value of f beyond 57,600 for the ratio dvs/u. It has been with this thought in mind that such a formula will be derived in this paper also.

From the (a) part of the line shown in Figure No. 2, which has a slope of 0.265, the empirical formula

$$f = \frac{0.364}{(dvs/u)^{0.265}} \qquad (3)$$

was developed.

From the (b) part of the broken line shown in Figure No. 2 the empirical value

$$f = \frac{0.157}{(dvs/u)^{0.188}} \qquad (4)$$

was obtained.

The experimental data of Wilson, McAdams and Seltzer, which was covered in their paper, "Flow of Fluid Through Commercial Pipe Lines," Journal of Industrial Chemistry, February, 1922, has been used by some designers of pipe lines. The coefficient of friction curves, based on their data, are 10 to 15 per cent too high for the sizes of pipe above 4 inches in diameter, but it is believed that their coefficients are nearly correct for the smaller sizes of pipe, say below 4 inches in diameter. Their tests were made on the smaller sizes of pipe in which the internal roughness becomes a factor, but is negligible in the large diameters. It is believed that the roughness factor accounts for the difference between the data of Wilson, McAdams and Seltzer and that of Stanton and Pannell which were obtained also from tests on small pipe, but with smooth interior walls. It is the author's opinion that the coefficient of friction curves developed from the data of Stanton and Pannell should be used for the sizes of pipe of nominal diameters including 4-inch and larger and the coefficients of Wilson, McAdams and Seltzer should be used for 2 and 3-inch pipe which are the smaller sizes of pipe used in oil pipe line gathering systems.

The previous discussion points to the possible use of four different formulas; therefore, it is felt that formulas should be developed for the following cases:

Case A—Streamline flow.

Case B—Turbulent flow when the value of dvs/u for the individual loops and the equivlent length is less than 57,600.

Case C—Turbulent flow when the value of dvs/u for the individual loops is less than 57,600 but greater than 57,600 for the equivalent length line.

Case D—Turbulent flow using the McAdams formula which incorporates a higher coefficient of friction value f. The author has

[1]T. E. Stanton and T. R. Pannell, Similarity of Motion in Relation to Surface Friction of Fluids; National Phys. Lab., London; vol. 2, pages 293-330, 1914.

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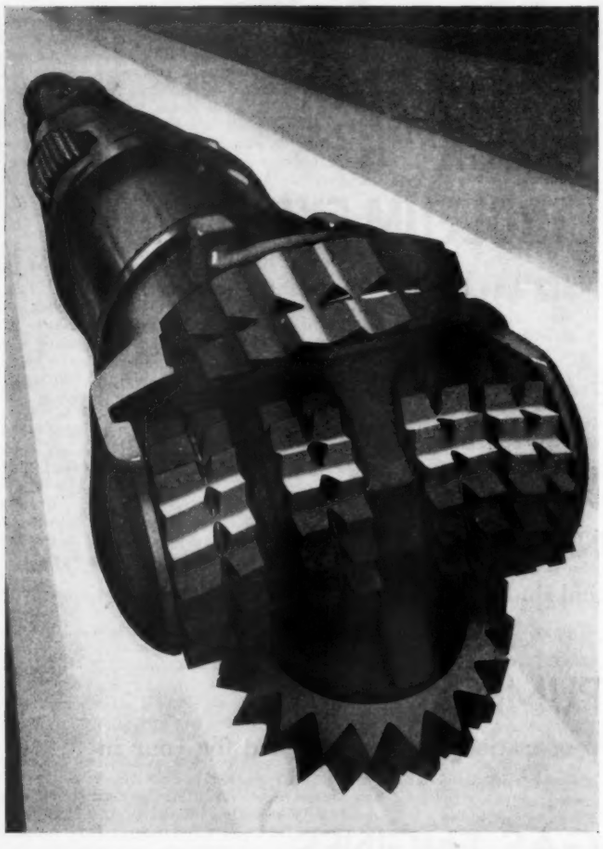

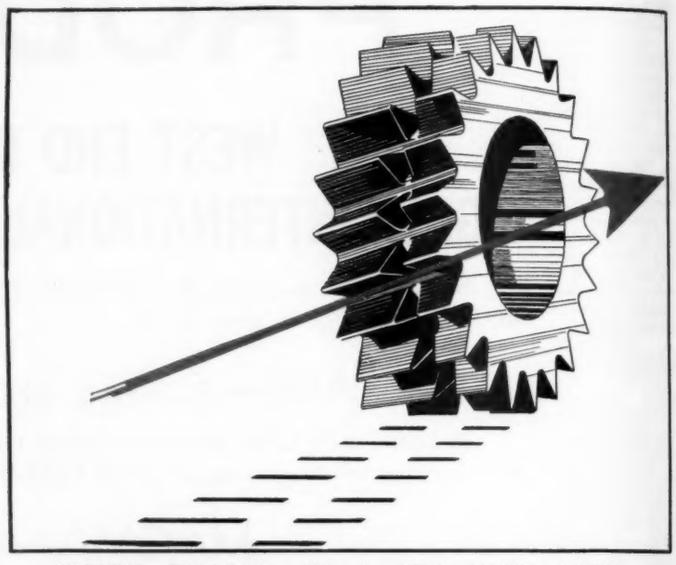

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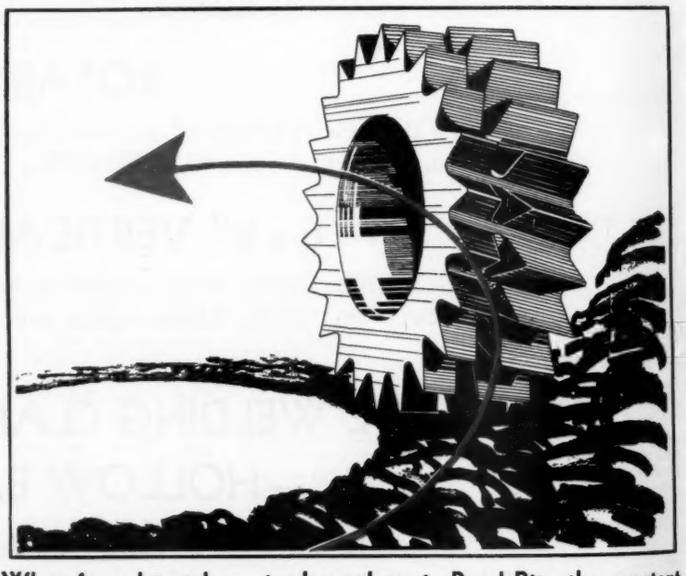

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pointed out, in discussing the data of Wilson, McAdams and Seltzer, that their coefficients of friction were too high for the larger commercial pipe lines, but would probably apply to the diameters below 4 inches.

Nomenclature

The following nomenclature will be used in the development of formulas for Cases A, B and C:

P = pressure drop pounds per sq. in. per mile.

P_0 = pressure drop pounds per sq. in. per mile of the individual loops.

P_x = pressure drop pounds per sq. in. per mile of equivalent length line.

B = total barrels per hour delivery.

$B_0, B_1, B_2 \ldots B_n$* = barrels per hour delivery through various parallel loops.

B_x = barrels per hour delivery through equivalent length line.

L_0 = length of the parallel loops.

L_x = equivalent length in miles.

D = internal diameter of pipe in inches.

$D_0, D_1, D_2 \ldots D_n$ = internal diameter of the individual loops in inches.

D_x = internal equivalent diameter in inches.

s = density of liquid in pounds per cu. ft.

u = absolute viscosity in foot-pounds. (English units)

u/s = kinematic viscosity in foot-poundal second units.

f = coefficient of friction.

*The subscript number (0) is used to identify the

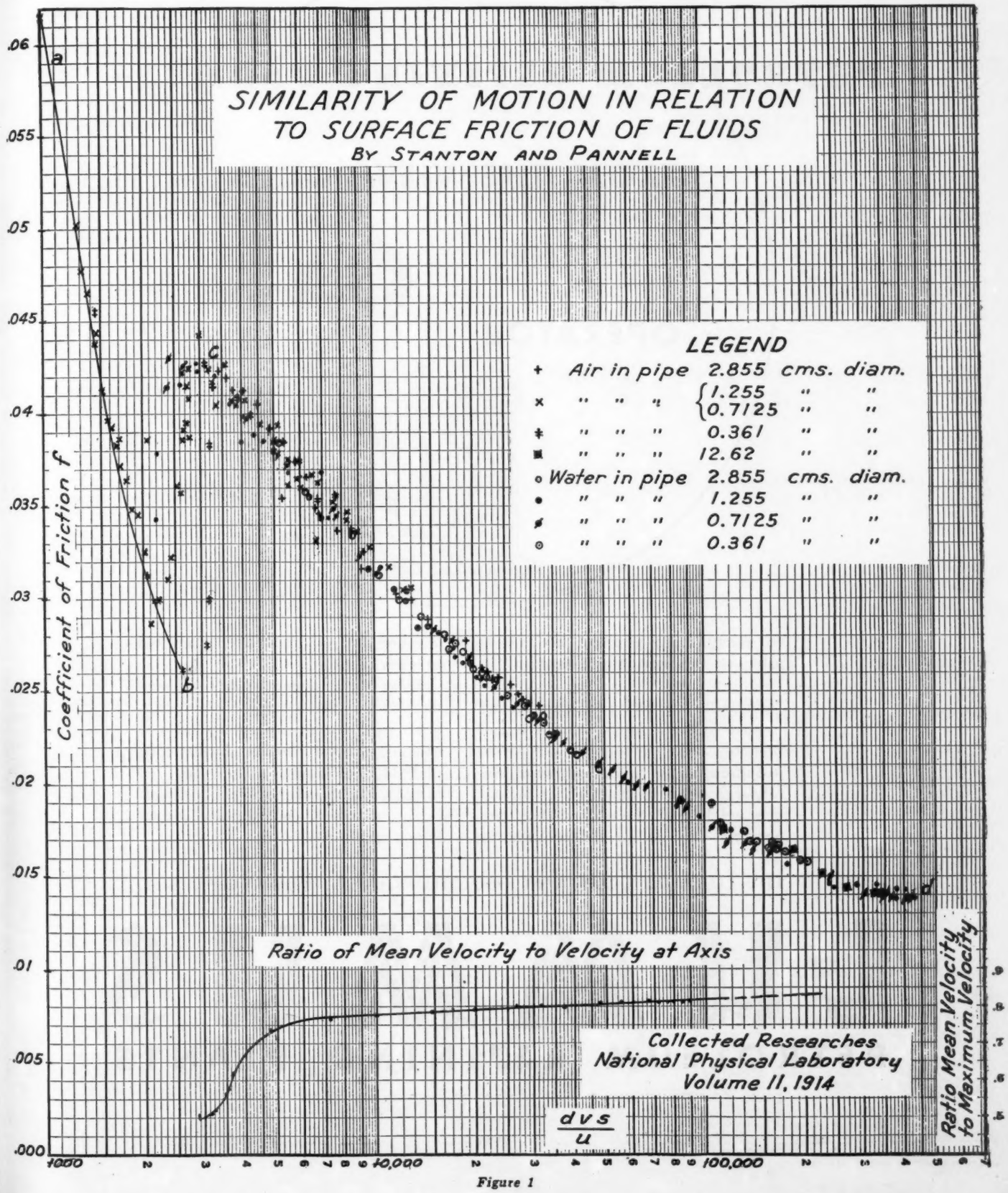

Figure 1

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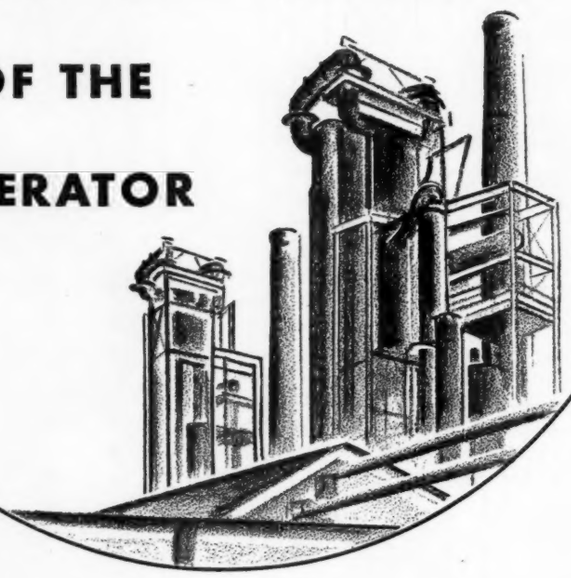

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first loop and the subscript letter (n) the last loop, and the numerals the intermediate loops. This nomenclature merely indicates that there may be more than two parallel lines.

Development of Formulas

Case A—Streamline flow: To determine the equivalent length for streamline flow, Equation No. 1 is used.

$$P = 1{,}500u(B/D^4)$$

The conditions are:

$B_x = B_0 + B_1 + B_2 + \dots B_n$
$P_0 = P_1 = P_2 = \dots P_n$
$L_0 = L_1 = L_2 = \dots L_n$
$u_x = u_0 = u_1 = \dots u_n$
$s_x = s_0 = s_1 = \dots s_n$
$P_xL_x = P_0L_0$

From Equation 1

$$B_x = \frac{P_xD_x^4}{1{,}500u_x}$$

and

$$B_0 = \frac{P_0(D_0)^4}{1{,}500u_0};\ B_1 = \frac{P_1(D_1)^4}{1{,}500u_1},\ \text{etc.}$$

Then

$$\frac{P_xD_x^4}{1{,}500u_x} = \frac{P_0D_0^4}{1{,}500u_0} + \frac{P_1D_1^4}{1{,}500u_1} + \dots \frac{P_nD_n^4}{1{,}500u_n} \quad (5)$$

Taking out the equals:

$$P_xD_x^4 = P_0\,(D_0^4 + D_1^4 + \dots D_n^4) \quad (6)$$

But

$$P_xL_x = P_0L_0$$

and

$$P_x = \frac{P_0L_0}{L_x} \quad (7)$$

$$\therefore \frac{P_0L_0D_x^4}{L_x} = P_0\,(D_0^4 + D_1^4 + \dots D_n^4) \quad (8)$$

$$\frac{L_0}{L_x} = \frac{D_0^4 + D_1^4 + \dots D_n^4}{D_x^4}$$

$$\frac{L_x}{L_0} = \frac{D_x^4}{D_0^4 + D_1^4 + \dots D_n^4}$$

$$L_x = \frac{D_x^4L_0}{D_0^4 + D_1^4 + \dots D_n^4} \quad (9)$$

Equation No. 9 is the final formula for determining the equivalent length formula for streamline flow conditions.

Case B—Turbulent Flow below 57,600 for the ratio

$$\frac{dvs}{u}$$

To determine the equivalent length for the conditions of this case, Equations Nos. 2 and 3 are used as the basis for the determination of the formula.

$$P = 0.5583\,f\frac{B^2\,S}{D^5}$$

$$f = \frac{0.364}{\left(\frac{dvs}{u}\right)^{0.265}}$$

But

$$v = 0.286\frac{B}{D^2} \quad (10)$$

Substituting the value of v in Equation 3 and converting d to D

$$f = \frac{0.364}{\left(\frac{D}{12}\,\frac{s}{u}\,\frac{0.286\,B}{D^2}\right)^{0.265}}$$

$$f = 0.983\left(\frac{D}{B}\right)^{0.265}\left(\frac{u}{s}\right)^{0.265} \quad (11)$$

Substituting the value of f in Equation 2

$$P = 0.5583\left(0.983\,\frac{u^{0.265}}{s^{0.265}}\,\frac{D^{0.265}}{B^{0.265}}\right)\left(\frac{B^2s}{D^5}\right)$$

$$P = 0.549\left(\frac{B^{1.735}}{D^{4.735}}\right)s^{0.735}u^{0.265} \quad (12)$$

$$B^{1.735} = \frac{P\,D^{4.735}}{0.549\,s^{0.735}\,u^{0.265}}$$

$$B = \left(\frac{P\,D^{4.735}}{0.549\,s^{0.735}\,u^{0.265}}\right)^{1/1.735} \quad (13)$$

Let $K = 0.549\,s^{0.735}\,u^{0.265}$
y' = exponent $1/1.735$
z = exponent 4.735

The following conditions are true for the parallel loops:

$P_x = P_1 = P_2 = P_n$
$B_x = B_0 + B_1 + \dots B_n$
$u_x^* = u_0 = u_1 = \dots u_n$
$s_x^* = s_0 = s_1 = \dots s_n$

*This is true on the assumption that the velocities in the different lines do not affect the viscosity as long as operations are in the turbulent region.

$$P_xL_x = P_0L_0$$

Then

$$B_x = \left(\frac{P_xD_x^z}{K_x}\right)^y = \left(\frac{P_0D_0^z}{K_0}\right)^y + \left(\frac{P_1D_1^z}{K_1}\right)^y + \dots \left(\frac{P_nD_n^z}{K_n}\right)^y$$

$$\frac{P_x^yD_x^{zy}}{K_x^y} = \frac{P_0^yD_0^{zy}}{K_0^y} + \frac{P_1^yD_1^{zy}}{K_1^y} + \dots \frac{P_n^yD_n^{zy}}{K_n^y}$$

$$= \frac{P_0^y}{K_0^y}\,(D_0^{zy} + D_1^{zy} + \dots D_n^{zy}) \quad (14)$$

Since $K_x = K_0 = K_1$, etc.,
and $P_0 = P_1 = P_2$, etc.,

$$P_x^yD_x^{zy} = P_0^y(D_0^{zy} + D_1^{zy} + \dots D_n^{zy}) \quad (15)$$

but $P_0L_0 = P_xL_x$

$$P_x = \frac{P_0L_0}{L_x}$$

and $$P_x^y = \frac{P_0^y\,L_0^y}{L_x^y}$$

Substituting this value of P_x^y in Equation 14

$$\frac{P_0^y\,L_0^y\,D_x^{zy}}{L_x^y} = P_0^y(D_0^{zy} + D_1^{zy} + \dots D_n^{zy}) \quad (16)$$

$$\frac{L_0^y}{L_x^y} = \frac{(D_0^{zy} + D_1^{zy} + \dots D_n^{zy})}{D_x^{zy}}$$

$$\frac{L_x}{L_0} = \frac{D_x^z}{(D_0^{zy} + D_1^{zy} + \dots D_n^{zy})^{1/y}}$$

$$L_x = \frac{D_x^{4.735}\,L_0}{(D_0^{2.73} + D_1^{2.73} + \dots D_n^{2.73})^{1.735}} \quad (17)$$

Equation 17 is the final formula for the equivalent length L_x for the condition of turbulent flow below 57,600 for the ratio dvs/u.

Case C—To determine the equivalent length for turbulent flow for values above 57,600 for the ratio dvs/u.

The following Formulas Nos. 2 and 4 are used to determine the equivalent length formula.

$$P = 0.5583f(B^2s/D^5) \quad (2)$$

$$f = \frac{0.157}{(dvs/u)^{0.185}} \quad (4)$$

Since $$dvs/u = \frac{0.02381Bs}{Du} \quad (18)$$

$$f = \frac{0.157\,D^{0.185}\,u^{0.185}}{(0.02381)^{0.185}\,B^{0.185}\,s^{0.185}}$$

$$f = 0.317(D/B)^{0.185}\,(u/s)^{0.185} \quad (19)$$

$$P = 0.5583[0.317(D/B)^{0.185}\,(u/s)^{0.185}]\,(B^2s/D^5)$$

$$P = 0.177(B^{1.815}/D^{4.815})\,s^{0.815}\,u^{0.185} \quad (20)$$

Then $$P_x = 0.177(B_x^{1.815}/D_x^{4.815})\,s^{0.815}\,u^{0.185} \quad (21)$$

$$B_x = \left(\frac{P_x\,D_x^{4.815}}{0.177\,u_x^{0.185}\,s_x^{0.815}}\right)^{1/1.815}$$

$$= \frac{P_x^{0.552}\,D_x^{2.65}}{0.3845\,u_x^{0.104}\,s_x^{0.448}} \quad (22)$$

It was proved under Case B the pressure loss per mile in the loops is expressed by the following equation:

$$P_0 = 0.549(B_0^{1.735}/D_0^{4.735})\,s_0^{0.735}\,u_0^{0.265}$$

Then $$B_0 = \left(\frac{P_0\,D_0^{4.735}}{0.549\,u_0^{0.265}\,s_0^{0.735}}\right)^{1/1.735}$$

$$= \frac{P_0^{0.576}\,D_0^{2.72}}{.708\,u_0^{0.153}\,s_0^{0.424}} \quad (23)$$

But $$B_x = B_0 + B_1 + B_2 + \dots B_n$$

Then $$\frac{P_x^{0.552}\,D_x^{2.65}}{0.3845\,u_x^{0.104}\,s_x^{0.448}} =$$

$$\left(\frac{P_0^{0.576}}{.708\,u_0^{0.153}\,s_0^{0.424}}\right)(D_0^{2.72} + D_1^{2.72} + \dots D_n^{2.72}) \quad (24)$$

But assuming parallel loops of equal distances:

$$P_xL_x = P_0L_0$$

$$P_x = \frac{P_0L_0}{L_x}$$

$$P_x^{0.552} = \frac{P_0^{0.552}\,L_0^{0.552}}{L_x^{0.552}} \quad (25)$$

Then $$\frac{P_0^{0.552}\,L_0^{0.552}\,D_x^{2.65}}{0.3845\,u_x^{0.104}\,s_x^{0.448}\,L_x^{0.552}} =$$

$$\left(\frac{P_0^{0.576}}{0.708\,u_0^{0.153}\,s_0^{0.424}}\right)(D_0^{2.72} + D_1^{2.72} + \dots D_n^{2.72}) \quad (26)$$

$$L_0^{0.552}/L_x^{0.552} =$$

$$\left(\frac{0.3845\,u_x^{0.104}\,s_x^{0.448}\,P_0^{0.576}}{0.708\,u_0^{0.153}\,s_0^{0.424}\,P_0^{0.552}}\right)\left(\frac{D_0^{2.72} + D_1^{2.72} + \dots D_n^{2.72}}{D_x^{2.65}}\right)$$

Since $u_0 = u_1 = u_x$
and $s_0 = s_1 = s_x$

$$(L_0/L_x)^{0.552} =$$

$$\left(\frac{0.543\,s^{0.424}\,P_0^{0.424}}{u^{0.049}}\right)\left(\frac{D_0^{2.72} + D_1^{2.72} + \dots D_n^{2.72}}{D_x^{2.65}}\right)$$

$$L_x/L_0 = \left(\frac{u^{0.049}}{0.543\,s^{0.424}\,P_0^{0.424}}\right)^{1/0.552} \times \left(\frac{D_x^{2.65}}{D_0^{2.72} + D_1^{2.72} + \dots D_n^{2.72}}\right)^{1/0.552}$$

$$L_x = \frac{u^{0.089}}{0.331\,s^{0.435}\,P_0^{0.435}}\,\frac{D_x^{4.81}\,L_0}{(D_0^{2.72} + D_1^{2.72} + \dots D_n^{2.72})^{1.812}}$$

Let $$C = \frac{u^{0.089}}{0.331\,s^{0.435}}$$

Then $$L_x = C\,\frac{D_x^{4.81}\,L_0}{P_0^{0.435}\,(D_0^{2.72} + D_1^{2.72} + \dots D_n^{2.72})^{1.812}} \quad (27)$$

which is the final formula for the equivalent length for values of dvs/u above 57,600.

Case D—Turbulent flow, using the formula of Wilson, McAdams and Seltzer, and their empirical value of f over the whole turbulent flow range.

Their formula (Page 115, February 1922, volume 14, Journal of Industrial and Engineering Chemistry) is

$$p = \frac{0.00323\,s^{0.8}\,z^{0.2}\,l_v^{1.8}}{D^{1.2}} \quad (28)$$

This formula gives the pressure loss in pounds per square inch per foot length.

This formula was derived by substituting in the Fanning equation their empirical value for f which is

$$f = 0.01\,(Dvs/z)^{0.2} \quad (29)$$

Nomenclature for Class D

p = pressure loss pounds per sq. in. per foot.
P = pressure loss pounds per sq. in. per mile.
l = length in feet.
s = specific gravity referred to water
z = relative viscosity with water at 68° F. (centipoises).
v = velocity in feet per second.
D = internal diameter in inches.
D_0, D_1, D_2—D_n—internal diameter in inches of individual loops.
D_x = internal diameter in inches of the equivalent length line.

(Continued on Next Page)

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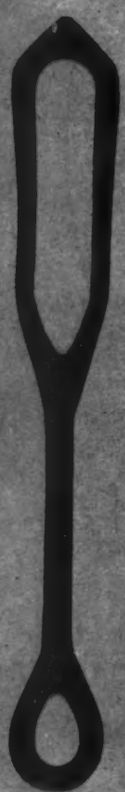

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B_o, B_1, B_2, B_x—barrels of fluid per hour through the various loops.

$K = 1.792\ s^{0.5}\ z^{0.2}$.

K_x = the constant for the equivalent length line.

K_o, K_1, K_2, K_n = the constant for the various loops.

L_x = equivalent length of line in mile.

L_o = length of parallel loops in miles.

P_x = pressure drop in pounds per sq. in. per unit length of equivalent length line.

P_o = pressure drop pounds per sq. in. per unit length of individual loops.

f = coefficient of friction determined empirically by Wilson, McAdams and Seltzer.

Substituting the value of v in equation (28)

$$v = 0.286\ \frac{B}{D^2}$$

and converting the formula to pressure loss per foot to pressure loss per mile by multiplying formula (28) by 5,280 feet.

$$P = 1.792\ \frac{B^{1.8}}{D^{4.8}}\ s^{0.2}\ z^{0.2} \qquad (30)$$

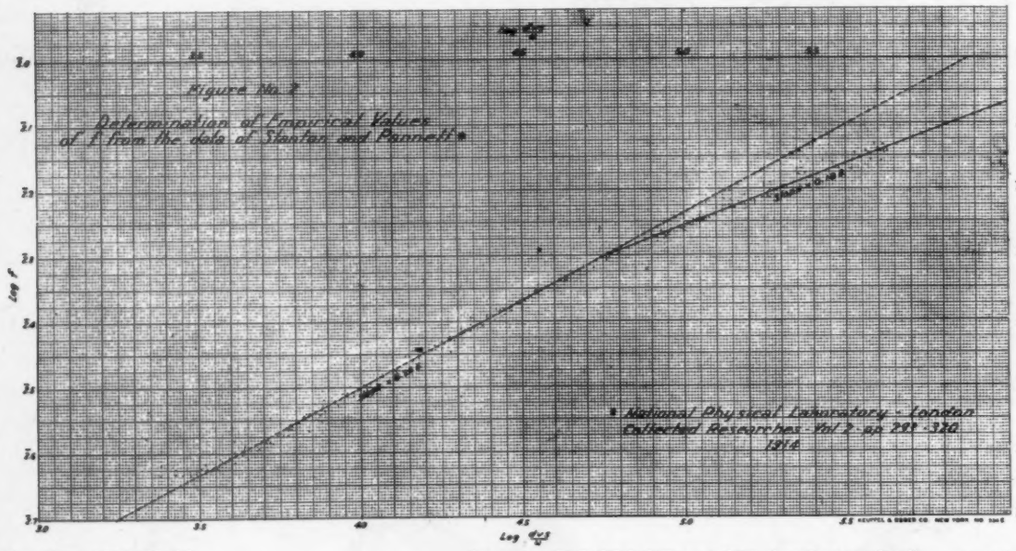
Figure No. 2
Determination of Empirical Values of f from the data of Stanton and Pannell*
* National Physical Laboratory - London
Collected Researches - Vol 2 - pp 281 - 320
1914
Log f
Log dvs/u

Using $K = 1.792\ s^{0.2}\ z^{0.2}$

Then $$P = \frac{K\ B^{1.8}}{D^{4.8}} \qquad (31)$$

The following conditions are true for parallel lines:

$$B_x = B_o + B_1 + B_2 \ldots\ldots B_n$$
$$P_o = P_1 = P_2 \ldots\ldots = P_n$$

Also $$P_x\ L_x = P_o\ L_o$$

Then $$P_x = \frac{P_o\ L_o}{L_x}$$

In words the pressure drop per unit length of the equivalent line multiplied by the equivalent length equals the pressure drop per unit length of one of the loops multiplied by the length of the loop.

Neglecting the possibility of any variation in viscosity or density in the turbent flow region at different velocites of flow in the individual loops.

$$K_x = K_o = K_1 = \ldots\ldots\ldots K_n$$

It should be pointed out also that the temperature of the oil in parallel lines is the same and the viscosity and the density of the oil should be the same in each line.

It follows from Equation (31) that—

$$B_x = \left(\frac{P_x\ D_x^{4.8}}{K_x}\right)^{1/1.8};\quad B_o = \left(\frac{P_o\ D_o^{4.8}}{K_o}\right)^{1/1.8};$$

$$B_n = \left(\frac{P_n\ D_n^{4.8}}{K_n}\right)^{1/1.8}$$

$$B_x = \left(\frac{P_x\ D_x^{4.8}}{K_x}\right)^{1/1.8} = \left(\frac{P_o\ D_o^{4.8}}{K_o}\right)^{1/1.8} + \left(\frac{P_1\ D_1^{4.8}}{K_1}\right)^{1/1.8} + \ldots\ldots \left(\frac{P_n\ D_n^{4.8}}{K_n}\right)^{1/1.8}$$

Canceling the values of K and letting

r = exponent 1/1.8

y = exponent 4.8

$$(P_x\ D_x^y)^r = (P_o\ D_o^y)^r + (P_1\ D_1^y)^r + \ldots\ldots (P_n\ D_n^y)^r$$
$$P_x^r\ D_x^{ry} = P_o^r\ D_o^{ry} + P_1^r\ D_1^{ry} + \ldots\ldots\ldots P_n^r\ D_n^{ry}$$

Then

$$\frac{P_o^r\ L_o^r\ D_x^{ry}}{L_x^r} = P_o^r\ (D_o^{ry} + D_1^{ry} + \ldots\ldots D_n^{ry}) \qquad (32)$$

$$\frac{L_o^r}{L_x^r} = \frac{(D_o^{ry} + D_1^{ry} + \ldots\ldots\ldots D_n^{ry})}{D_x^{ry}}$$

$$\frac{L_x}{L_o} = \frac{D_x^y}{(D_o^{ry} + D_1^{ry} + \ldots\ldots D_n^{ry})^{1.8}}$$

$$L_x = \frac{D_x^{4.8}\ L_o}{(D_o^{2.66} + D_1^{2.66} + \ldots\ldots D_n^{2.66})^{1.8}} \qquad (33)$$

Equation (33) is the final formula for computing the equivalent length under Case D.

Conclusion

This paper offers four formulas, which were developed for cases "A," "B," "C" and "D" described in detail above. As a resume these four formulas are shown in this conclusion with the thought that perhaps they will stand out more clearly here than in the body of the paper. The author regretted the necessity of showing so many algebraic equations, but it was felt desirable to show all the details to avoid misunderstandings as to their use. An exponential formula often looks more complicated than it really is and that is the case of the equations which are shown below.

If the formulas are not understood at first, it is suggested that the reader follow through the problems which will make one familiar with the formulas. In fact, I think that it is desirable not to try to analyze a paper until the reader has tried working the illustrated problems first to get acquainted with the formulas and equations. It is the practical use of the formulas that make one interested in the details of the paper.

LIST OF FORMULAS

Case "A," Formula (9), stream line flow:

$$L_x = \frac{D_x^4\ L_o}{D_o^4 + D_1^4 + \ldots D_n^4}$$

Case "B," Formula (17), turbulent flow for values below 57,600 for the ratio dvs/u for sizes of pipe 4 inches in diameter and above:

$$L_x = \frac{D_x^{4.735}\ L_o}{(D_o^{2.73} + D_1^{2.73} + \ldots D_n^{2.73})^{1.735}}$$

Case "C," Formula (27), turbulent flow for sizes of pipe 4 inches in diameter and above in which values of dvs/u are less than 57,600 for the individual loops and more than 57,600 for the equivalent length line.

$$L_x = C\ \frac{D_x^{4.81}\ L_o}{P_o^{0.435}\ (D_o^{2.73} + D_1^{2.73} + \ldots D_n^{2.73})^{1.812}}$$

Case "D," Formula (33), turbulent flow for sizes of pipe smaller than 4 inches the formula of Wilson, McAdams and Seltzer disregarding the different empirical f values for dvs/u above or below 57,600.

$$L_x = \frac{D_x^{4.8}\ L_o}{(D_o^{2.66} + D_1^{2.66} + \ldots D_n^{2.66})^{1.8}}$$

Formula No. 17, which is used in case "A" is the only one of these four formulas which the author can offer as having been proved by practice; but the same principles are used in the derivation of the other three formulas as in Formula No. 17, and it is reasonable to believe that they can be used in practice; however, the purpose of offering them in this paper is to have them checked by industry. The author can vouch for Formula No. 17, because it has been used to design hundreds of miles of loops with accuracy.

There may be some question about the use of a separate formula for turbulent flow above the value 57,600 for the ratio dvs/u. In this development of the equivalent length formula it was desirable to obtain an empirical value of f which would be the most workable in the derivations; for that reason and since there were data available to prove only the reliability of Stanton and Pannell figures in practice up to the value of 57,600 it was believed desirable to have empirical values of f to cover the two separate ranges. For most practical purposes there will be little or no occasion to use the formula developed in case "C."

Examples

The use of Formula No. 17, Case "A" is demonstrated by the following problems. The first problem will show the simplest calculation of an equivalent length of a group of parallel lines of the same diameter; one group will be 6-inch lines and the other will be 8-inch lines.

The second problem will be an example of a section of an operating system which is shown diagrammatically with the problem. In this case the lines of diameter from 6 to 12-inch will be involved.

The calculation of these two problems will demonstrate also the procedure to be followed in computing the table of equivalent lengths for a multiple system of lines, which is shown below.

Problem No. 3 demonstrates the use of the equivalent length in designing additional loops to obtain certain capacities.

Problem (1):

Equivalent Lengths from Formula (17), Case "A"

(a) Reduce a group of three 8-inch parallel lines having a length of 23 miles to an equivalent 10-inch line.

$$L_x = \frac{D_x^{4.735}\ L_o}{(D_o^{2.73} + D_1^{2.73} + D_2^{2.73} + \ldots D_n^{2.73})^{1.735}} \qquad (17)$$

Where

L_x = equivalent length of 10 inches.

L_o = length of parallel loops.

Note: In compiling data for a table of equivalent lengths it is well to consider only 1 mile of looped lines. The value L_x can then be taken from the table and multiplied by the length of the parallel loops under consideration.

∴ Let $L_o = 1$.

D_x = equivalent diameter (inside).

D_o, D_1, D_2 ... D_n = inside diameters of the parallel loops.

Solution

$$L_x = \frac{10.02^{4.735} \times 1}{(7.981^{2.73} + 7.981^{2.73} + 7.981^{2.73})^{1.735}}$$

CALCULATIONS ARE SHOWN IN TABLE BELOW

Nominal I.D.	I.D.*	Log I.D.	2.73 log I.D.	I.D.$^{2.73}$	1.735 log	4.735 log I.D.
D_o-8"	7.981	.90206	2.46262	290.15		
D_1-8"	7.981	.90206	2.46262	290.15		
D_2-8"	7.981	.90206	2.46262	290.15		
Ttl. I.D.$^{2.73}$				870.45	5.10045	
D_x-10" ...	10.020	1.00087				4.73912

*I.D. = Inside diameter.

L_x = log 4.73912—log 5.10045 = log 9.63867—10.

L_x = 0.4352 which is the equivalent length factor.

This figure will correspond with the value given in equivalent length table. Thus $0.4352 \times 23 = 10.0$ miles equivalent length of 10-inch line.

(b) Reduce a loop of two 6-inch lines having a length of 15 miles, to an equivalent 8-inch line.

(Continued on Next Page)

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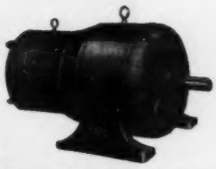

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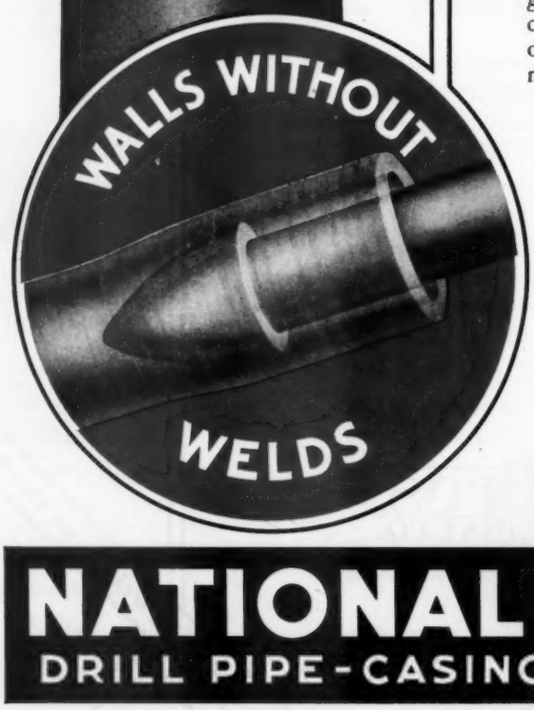

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Solution:

$$L_x^* = \frac{7.981^{4.735}}{(6.065^{2.73} + 6.065^{2.73})^{1.735}} \qquad (17)$$

*See (a) problem 1 for notations on Formula (17).

CALCULATIONS ARE SHOWN IN TABLE BELOW

Nominal I.D.	I.D.*	Log I.D.	2.73 log I.D.	I.D.$^{2.73}$	1.735 log	I.D. 4.735 log
D_0-6"	6.065	.78283	2.13712	137.12		
D_1-6"	6.065	.78283	2.13712	137.12		
Ttl. I.D.$^{2.73}$				274.24	4.23016	
D_x-8"	7.981	.90206				4.27125

*I.D. = Inside diameter.

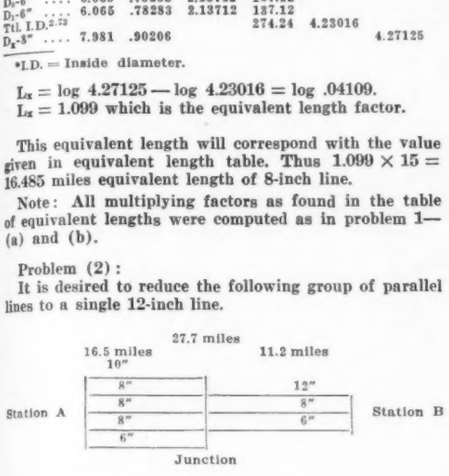
L_x = log 4.27125 — log 4.23016 = log .04109.
L_x = 1.099 which is the equivalent length factor.

This equivalent length will correspond with the value given in equivalent length table. Thus 1.099 × 15 = 16.485 miles equivalent length of 8-inch line.

Note: All multiplying factors as found in the table of equivalent lengths were computed as in problem 1—(a) and (b).

Problem (2):

It is desired to reduce the following group of parallel lines to a single 12-inch line.



$$L_x^* = \frac{D_x^{4.735}\ L_o}{(D_o^{2.73} + D_1^{2.73} + D_2^{2.73} + D_3^{2.73} + \ldots D_n^{2.73})^{1.735}} \qquad (17)$$

*See (a) Problem 1 for notations on Formula (17).

Station A to junction:

$$L_x = \frac{12.000^{4.735} \times 1}{(6.065^{2.73} + 7.981^{2.73} + 7.981^{2.73} + 7.981^{2.73} + 10.020^{2.73})^{1.735}}$$

CALCULATIONS ARE SHOWN IN TABLE BELOW

Nominal I.D.	I.D.*	Log I.D.	2.73 log I.D.	I.D.$^{2.73}$	1.735 log	I.D. 4.735 log
D_0-6"	6.065	.78283	2.13712	137.12		
D_1-8"	7.981	.90206	2.46262	290.15		
D_2-8"	7.981	.90206	2.46262	290.15		
D_3-8"	7.981	.90206	2.46262	290.15		
D_4-10" 10.020		1.00087	2.73273	539.97		
Ttl. I.D.$^{2.73}$				1547.54	5.53403	
D_x-12" ...12.000		1.07918				5.10992

*I.D. = Inside diameter.

L_x = log 5.10992 — log 5.53404 = log 9.57589 — 10.
L_x = 0.3766 which is the equivalent length factor.

Station A to Junction = 0.3766 × 16.5 = 6.214 miles of equivalent 12-inch line.

Junction to Station B:

$$L_x = \frac{12.000^{4.735} \times 1}{(12.000^{2.73} + 7.981^{2.73} + 6.065^{2.73})^{1.735}}$$

CALCULATIONS ARE SHOWN IN TABLE BELOW

Nominal I.D.	I.D.*	Log I.D.	2.73 log I.D.	I.D.$^{2.73}$	1.735 log	I.D. 4.735 log
D_0-12" ...12.000		1.07918	2.94616	883.40		
D_1-8"	7.981	.90206	2.46262	290.15		
D_2-6"	6.065	.78283	2.13712	137.12		
Ttl. I.D.$^{2.73}$				1310.67	5.40885	
D_x-12" ...12.000		1.07918				5.10992

*I.D. = Inside diameter.

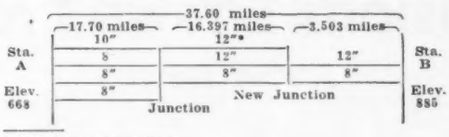
L_x = log 5.10992 — log 5.40885 = log 9.70107 — 10.
L_x = 0.5024 which is the equivalent length factor.

Junction to Station B = 0.5024 × 11.2 = 5.627 miles of equivalent 12-inch line.

Station A to Station B = 6.214 + 5.627 = 11.841 miles of equivalent 12-inch line.

Problem (3):

Consider the case of increasing the line capacity of the loop sketched below to 100,000 bbls. per day. Present capacity of the loop is 81,500 bbls. per day. The average A.P.I. gravity handled through the loop is 36 degrees and the winter viscosity is approximately 90 Saybolt seconds. The maximum gauge pressure allowable at Station A is 650 pounds per square inch.



*Proposed new loop.

In order to determine the pressure drop per mile for the increased capacity of this loop, it is necessary to use a capacity chart for the equivalent line which in this case is 12-inch. This chart can be plotted from values of P, using several values of B and then the barrels per hour or per day for any value of P can be determined.

The reason for this procedure is that in the formula $P = 0.55830\ f\ B^2 s/D^5$, the value of f is a function of dvs/u, and

$$\frac{dvs}{u} = \frac{.02381}{D} B \frac{s}{u}$$

Since B is the unknown in Problem (3), one cannot compute the value P from the equation above because of the two unknowns f and B.

Assuming the use of such a chart, one finds from the data given in Problem (3), that the pressure drop per mile for a capacity of 100,000 bbls. per day is 41.6 pounds per square inch, which is the permissible pressure drop per mile in the equivalent length of the new system.

The effective pressure at the station "A" must take into account differences in elevation. 885 — 668 = 217' hill pressure that must be overcome. Pressure in pounds per square inch per foot elevation for 36 degree gravity oil is 0.366.

0.366 × 217 = 79 pounds per square inch.

Effective pressure at Station A = 650 — 79 = 571 pounds per square inch.

The effective pressure head at the station divided by the permissible pressure drop per mile of the new system will give:

$$\frac{571}{41.6} = 13.726 \text{ miles}$$

which will be the equivalent length of the system after the new loop is added.

An examination of the hydraulic gradient of the old system of loops shows that the most desirable place to increase the capacity is between the junction and Station B.

Let L = length of new line to be laid.

Then:

$$13.726 = (17.70)\ (0.442^*) + (19.90 - L)\ 0.6086^{**} + 0.23L^{***}$$

From table of equivalent lengths:

8", 8", 8", 10" to 12" = 0.442* multiplying factor.
8", 12" to 12" = 0.6086** multiplying factor.
8", 12", 12" to 12" = 0.23*** multiplying factor.

$$13.726 = 7.823 + 12.111 - 0.6086L + 0.23L$$

from which 0.3786L = 6.208.

L = 16.397 miles of new 12-inch to be laid to increase the capacity from 81,500 to 100,000 bbls. per day.

Table of Equivalent Lengths

These equivalent lengths are computed for turbulent flow "Case B" for values of dvs/u below 57,600 and for the internal diameters shown in the table in the next column:

Nominal diameter inches	Internal diameter inches
6	6.065
8	7.981
10	10.02
12	12.00
14	13.25
16	15.25

Reduce—	To	Multiply lengths of loop by
6"	12"	25.2400
6"-8"	12"	3.5130
6"-8"-8"	12"	1.4294
6"-8"-8"-8"	12"	0.7929
6"-8"-8"-8"-8"	12"	0.5111
6"-8"-10"	12"	0.8512
6"-8"-8"-10"	12"	0.5400
6"-8"-8"-8"-10"	12"	0.3766
6"-8"-8"-8"-8"-10"	12"	0.2795
6"-8"-10"-10"	12"	0.3595
6"-8"-8"-10"-10"	12"	0.2951
6"-8"-8"-8"-10"-10"	12"	0.2236
6"-8"-8"-8"-8"-10"-10"	12"	0.1788
6"-8"-10"-12"	12"	0.2761
6"-8"-8"-8"-10"-12"	12"	0.1724
6"-8"-10"-12"-12"	12"	0.1787
6"-8"-12"	12"	0.5030
6"-8"-12"-12"	12"	0.2065
6"-8"-12"-12"-12"	12"	0.1143
6"-8"-12"-14"	12"	0.1675
6"-8"-12"-14"-14"	12"	0.0684
6"-10"	12"	1.9400
6"-12"	12"	0.7755
8"	12"	6.8750
8"-8"	12"	2.0650
8"-8"-8"	12"	1.0220
8"-8"-8"-8"	12"	0.6205
8"-10"	12"	1.1100
8"-8"-10"	12"	0.6600
8"-8"-8"-10"	12"	0.4420
8"-8"-8"-8"-10"	12"	0.3170
8"-10"-10"	12"	0.4653
8"-8"-10"-10"	12"	0.3334
8"-8"-8"-10"-10"	12"	0.2455
8"-8"-10"-10"-10"	12"	0.2042
8"-10"-12"	12"	0.3156
8"-8"-10"-12"	12"	0.2400
8"-8"-8"-10"-12"	12"	0.1950
8"-10"-10"-12"	12"	0.1962
8"-10"-12"-12"	12"	0.1530
8"-10"-12"-12"-12"	12"	0.0911
8"-12"	12"	0.6086
8"-8"-12"	12"	0.4150
8"-8"-8"-12"	12"	0.3030
8"-12"-12"	12"	0.2300
8"-12"-12"-12"	12"	0.1230
8"-10"-14"	12"	0.2439
8"-8"-10"-14"	12"	0.1925
8"-12"-16"	12"	0.1287
10"	12"	2.3400
10"-10"	12"	0.7030
10"-10"-10"	12"	0.3480
10"-12"	12"	0.4356
10"-10"-12"	12"	0.2480
10"-12"-12"	12"	0.1905
10"-12"-14"	12"	0.1550
10"-12"-12"-14"	12"	0.0930
10"-14"	12"	0.3207
10"-14"-16"	12"	0.0962
12"-12"	12"	0.2992
12"-12"-12"	12"	0.1483
12"-14"	12"	0.2329
12"-12"-14"	12"	0.1248
12"-14"-16"	12"	0.0814
12"-16"	12"	0.1549
14"	12"	0.6227
14"-14"	12"	0.1871
14"-16"	12"	0.1300
16"	12"	0.3201
6"	10"	10.7500
6"-6"	10"	3.2280
6"-8"	10"	1.5000
6"-6"-8"	10"	0.9220
6"-8"-8"	10"	0.6086
6"-8"-10"	10"	0.3624
8"	10"	2.9300
8"-8"	10"	0.8800
8"-8"-8"	10"	0.4352
8"-10"	10"	0.4725
8"-8"-10"	10"	0.2810
8"-10"-10"	10"	0.1982
8"-10"-12"	10"	0.1384
10"-10"	10"	0.2994
10"-12"	10"	0.1800
12"	10"	0.4145
4"-4"	8"	7.6559
4"-6"	8"	2.2406
4"-6"-8"	8"	0.4284
4"-6"-6"-8"	8"	0.2752
6"	8"	3.6736
6"-6"	8"	1.059
6"-8"	8"	0.5093
6"-8"-8"	8"	0.2072
8"-8"	8"	0.2995
4"	6"	6.9460
4"-4"	6"	2.0870
4"-6"	6"	0.6107
6"-6"	6"	0.2995
6"-8"	6"	0.1388

Acknowledgment

The author acknowledges with appreciation the help and encouragement of C. M. Scott in the derivation of the formulas about six years ago; also the assistance of J. J. Boyd and D. C. Brown in checking the formulas for publication. Mr. Brown assisted, also, in the preparation of the problems.

NEW TIDE WATER DIRECTORS

NEW YORK, May 7.—Six new directors, representing important banking, railroad and oil interests, have been elected to the Tide Water Oil Co. The new members are Henry W. De Forest, H. Paul Grim, Elisha Walker, J. Paul Getty, George N. Armsby and Paul Shoup. Retiring directors were re-elected with the exception of Henry S. Sturgis, resigned.

Of the new interests Mr. De Forest and Mr. Shoup are connected with the Southern Pacific Co., Mr. Walker is a partner in Kuhn, Loeb & Co.; J. Paul Getty, a Pacific Coast oil man, with associates is understood to have acquired substantial interests in the company.

CANADA TAKES MONTANA CRUDE

Official figures of the secretary of the Montana oil conservation board show that in February, out of a production of 158,707 bbls., some 87,141 bbls. or more than half, were shipped to Canadian refineries. Most of this crude was taken by Alberta plants, the plants at Coutts, on the international line, being connected with the Montana border fields by pipe line. The Canadian plants took 28,012 bbls. from the Border and Kevin-Sunburst Fields, 13,606 bbls. from Cat Creek, and 16,468 bbls. from Pondera, the latter being practically the entire production. Canadian plants also took 28,006 bbls., the entire production reported from the Cut Bank Field.

BARNSDALL PROFIT

Barnsdall Corp. reports a net profit of $119,368.25 after deducting all charges and without writing up inventories remained at the close of the first quarter of this year. This compared with a net loss of $852,803.09 for the same period in 1933.

E. B. Reeser, president, said the corporation and its subsidiaries had paid all bank loans in full, had no bonds or preferred stock and no indebtedness other than current accounts and a small amount of purchase obligations, and as of March 31 had a current statistical condition of 3½ to 1.

XUM

Air-Gas Compressor Characteristics With Seven Leading Conclusions Drawn From Long Study

By JOHN P. KLEP
C.R.B. Belgian Graduate Fellow at the University of Oklahoma*

A compressor is a machine designed for compressing air or gas from an initial intake pressure to a higher discharge pressure. The volumetric efficiency of a compressor is the ratio between the low pressure capacity and the displacement volume, measured at supply pressure conditions.

Clearance is the space enclosed between the piston and the cylinder head at the end of the stroke.

Theoretically, the clearance does not

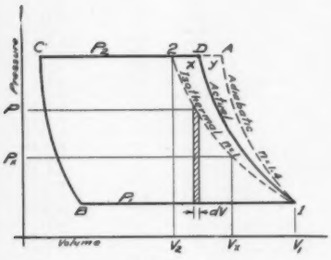


Figure 1

affect the work done by the compressor. The air in the clearance space reacts like a spring, absorbing and giving back energy alternately. In other words, clearance affects the volumetric output of the compressor, but not the work of compression for a given volume of air taken into the cylinder. The clearance of a compressor is the ratio of the clearance volume to the piston displacement.

Any increase in the clearance volume of a compressor decreases the volumetric efficiency.

The free air capacity of a compressor is often misunderstood to be the volume swept through by the piston, without making any deduction: For example, if the area of the piston is 2 square feet and the latter travels 500 feet per minute, the capacity is called 1,000 cubic feet per minute. This conception is erroneous. The above defined volume is not the low pressure capacity but the displacement volume of the piston, if no clearance existed.

Assuming that the volume swept through by the piston in one stroke is 1,000 cubic inches and that the compressor has 2 per cent clearance, the clearance volume would be 20 cubic inches.

If the supply pressure is standard atmospheric at sea level, or 14.7 pounds per square inch absolute and if the discharge pressure is 75 pounds per square

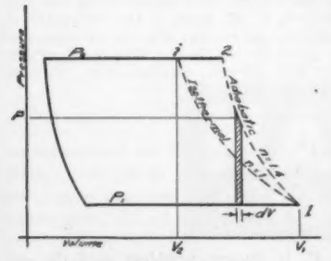


Figure 2

inch gauge, or 89.7 pounds per square inch absolute, the air remaining in the 20 cubic inch clearance space will re-

*Prepared for presentation at meeting A.S.M.E., Tulsa.

expand on the return stroke of the piston to $\frac{89.7}{14.7}$ or about 6 times the clearance volume, or to 120 cubic inches and will, therefore, take up an additional 120–20 = 100 cubic inches from the intake cylinder. That is, in a cylinder of 1,000 cubic inches piston displacement the piston must travel back $\frac{1,000}{100}$ or 10 per cent of the return stroke before the clearance air has expanded to atmospheric pressure and before the atmospheric air is allowed to flow into the cylinder. The actual room for the admission of new free air, or low pressure capacity, is therefore only 1,000–100 = 900 cubic inches, or as commonly stated, the volumetric efficiency of the compressor is 90 per cent.

The mechanical efficiency of a compressor is the ratio of the power required to compress and deliver a given quantity of air or gas to the power actually consumed.

Compression efficiency, as defined by the writer, is the ratio of the horsepower required to compress isothermally the amount of air delivered to the actual indicated horsepower required in the air compressing cylinder as shown by the indicator diagrams.

In Figure 3 are presented a series of curves showing the power economy of isothermal and polytropic compression over adiabatic compression.

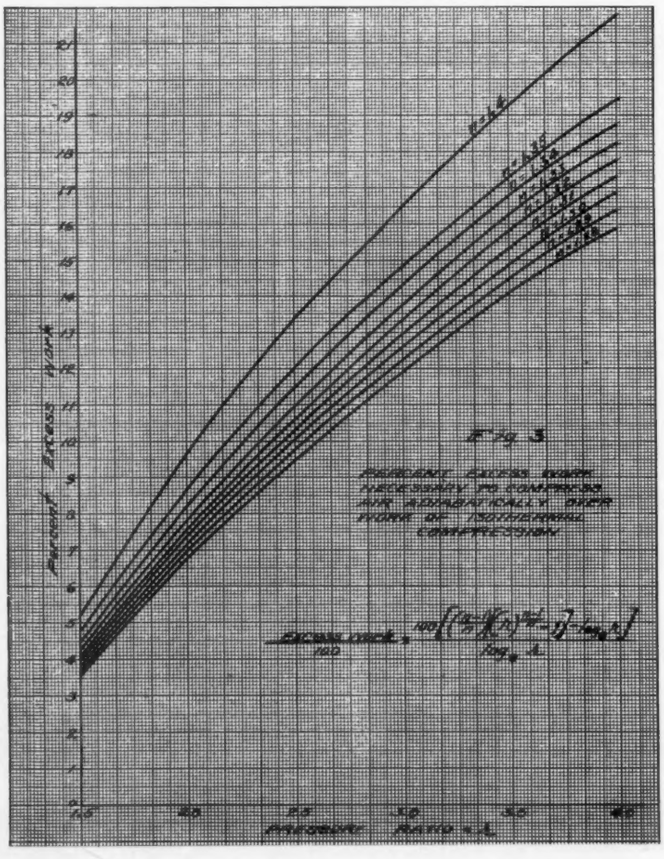


Fig. 3

It was formerly believed that many gases, such as air, O_2, N_2 and H_2 could not be liquefied at any temperature, and to these were given the name of permanent gases. All gases now known, however, have been liquefied. In temperature ranges far above their liquefying point, all gases follow quite closely certain simple laws or relationships among their several properties. A perfect gas is a hypothetical gas which would follow these simple laws exactly.

The characteristic equation, derived from Boyle's and Charles' laws.

$$PV = w\,RT$$

expresses the relation between pressure P in pounds per square foot absolute, volume V in cubic feet occupied by w pounds of gas at temperature of T degrees F. absolute. R is a constant and, for any gas, is equal to $\frac{1,544}{m}$, where m is the molecular weight.

The characteristic equation is often more conveniently used in the form

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} = \frac{PV}{T}$$

Isothermal and Adiabatic Conditional Relations

Changes of a gas from one condition to another are all special cases of the general polytropic change.

These changes may be effected at constant volume (isochoric), at constant pressure (isobaric), at constant temperature (isothermal), or at constant entropy (adiabatic). During the compression cycle in a compressor, these changes are intermediate between isothermal and adiabatic conditions, but approach the adiabatic state. An adiabatic change incurs no exchange of heat. Increase of entropy is a quantity which, when multiplied by the lowest available temperature, gives the heat.

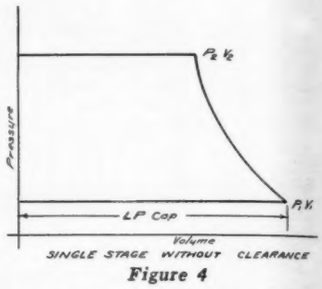


Figure 4

The formula for total work in an isothermal compression is

$$W = 2.31\,P_1V_1 \log_{10}\frac{P_2}{P_1} \qquad (1)$$

and is derived from Boyle's law.

For an adiabatic compression, PV^k is a constant, where $K = \frac{c^p}{c^v}$ or the ratio of the specific heats of the gas at constant pressure and at constant volume. To avoid confusion, the exponent K will serve to indicate the perfect adiabatic state and the letter n will be used for all other conditions. Under these conditions

$$W = \frac{P_1V_1}{n-1}\left[\left(\frac{P_2}{P_1}\right)^{\frac{n-1}{n}} - 1\right] \qquad (2)$$

In air compressor work n varies between 1.28 and 1.35. From the above equations, graphically represented in Figures 1 and 2, it will be seen that isothermal compression requires less work than adiabatic, the latter term referring to all conditions where n is larger than one.

Determination of n From the Indicator Cards and Figure 3

A method is herewith presented to determine the value of n when the indicator cards are available.

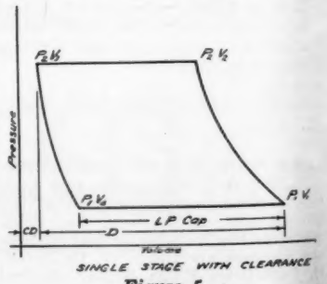


Figure 5

Let W_1 and W_a be the work done on the air, respectively isothermally and adiabetically under identical conditions.

The per cent excess work of the adia-

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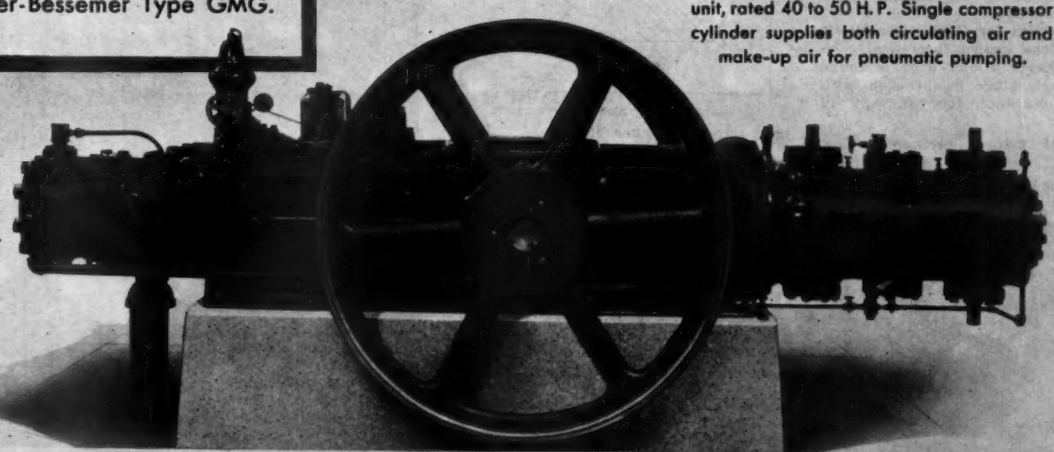
AT the International Petroleum Exposition in Tulsa, a hook-up similar to the actual field installation, pictured above, is in operation. A modern COOPER-BESSEMER GMG air compressor is driving a Sullivan pneumatic pumping head. Cooper-Bessemer has pioneered the development of special compressors for this service. Standard sizes are available from 30 to 200 H. P. Stop at the Sullivan exhibit and see the Cooper-Bessemer Type GMG.

TYPE GMG COOPER-BESSEMER compressor unit, rated 40 to 50 H. P. Single compressor cylinder supplies both circulating air and make-up air for pneumatic pumping.



THE COOPER-BESSEMER CORPORATION

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225 Crockett Street, Shreveport, La.
505 Esperson Building, Houston, Texas

batic compression over the isothermal compression is expressed by the following formula:

$$\frac{X_2W}{100} = \frac{100\,(W_2 - W_1)}{W_1} = \frac{100\left[\frac{n}{n-1}P_1V_1\left[(r)^{\frac{n-1}{n}} - 1\right] - 2.3\,P_1V_1\log_{10}r\right]}{2.3\,P_1V_1\log n} = \frac{43.5\left[\frac{n}{n-1}(r)^{\frac{n-1}{n}} - 1\right] - 2.3\log_{10}r}{\log r} \quad (3)$$

The curves of Figure 3 were obtained by plotting the values of r (ratio of pressures $= \frac{P_2}{P_1}$) against per cent increase of work for various values of n ranging from 1.28 to 1.4.

The pressure ratios can be determined from the indicator cards by taking an average high pressure line and an average low pressure line and dividing P_2 (high) by P_1 (low).

In order to determine $\frac{X_2W}{100}$, a planimeter is used on the indicator cards. Referring to Figure 1, the area of the card 1 DCB is measured with a planimeter. This gives an area A. Then, from point 1, the theoretical isothermal line is drawn to its intersection 2 with AC.

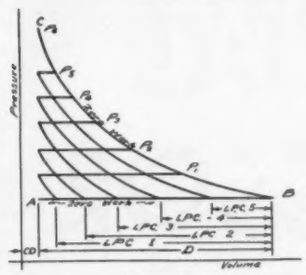


Figure 6

This line is drawn by points, using the equation $P_xV_x = P_1V_1$. Assuming a value for P_x the corresponding V_x is found, giving a point on the curve, and so on.

The area 12 CB is measured with a planimeter, giving a_1. Thus

$$\frac{X_2W}{100} = \frac{100(a-a_1)}{a_1}$$

and the value of n can be read on or between the curves of Figure 3 for known co-ordinates.

Actual Formulas for Compressor Work

By using the known theoretical relations on Figures 4 and 5 it is found that for single stage compression with or without clearance, the net work in foot pounds:

$$W_{net} = 144\ (\text{supply pressure})\ (\text{Low Pressure Capacity})\ \frac{n}{n-1}\left[(r)^{\frac{n-1}{n}} - 1\right] \quad (4)$$

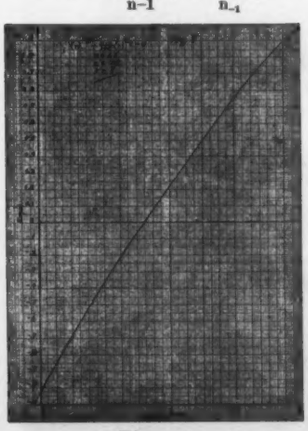


Figure 7

where the supply pressure (SP) is expressed in pounds per square inch and Low Pressure Capacity (LPC) in cubic feet.

When there is no clearance, LPC = D (displacement volume), but if a clearance space exists, a new factor E_v (volumetric efficiency) is introduced. By definition

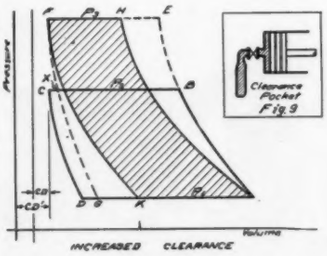


Figure 8

$$E_v = \frac{LPC}{D}$$

And (4) becomes

$$W_{net} = 144 \times D \times MEP =$$

$$144\ (SP)\ E_vD\ \frac{n}{n-1}\left[(r)^{\frac{n-1}{n}} - 1\right] \quad (5)$$

where MEP is the mean effective pressure.

Relation Between Volumetric Efficiency and Clearance Volume

$$E_v = \frac{LPC}{D}$$

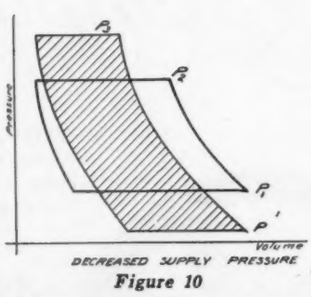


Figure 10

Referring to Figure 5:

$$LPC = V_3 - V_4 = D - cD - V_4$$

and V_4 is found from the equation of the expansion line

$$P_2V^n_2 = P_1V^n_4$$

$$V_4 = \left(\frac{P_2}{P_1}\right)^{1/n} V_2 = cD(r)^{1/n}$$

Therefore $E_v = 1 + c - cr^{1/n}$ (6)

Formula (6) shows that, for a given clearance, the volumetric efficiency decreases as the pressure ratio increases.

Figures 5 and 6 also bring out this mathematical evidence. If the discharge pressure is increased, for a given supply pressure, the re-expansion of the gas remaining in the clearance space of the cylinder at the end of the discharge, starts at a higher point on the pressure ordinate. The expansion curve will therefore cross the horizontal supply pressure line to the right of point P_1V_4 (Figure 5) and, as P_2 increases, this point of intersection approaches point P^1V_1, tending toward a re-expansion following the comparison line for which case no work would be done.

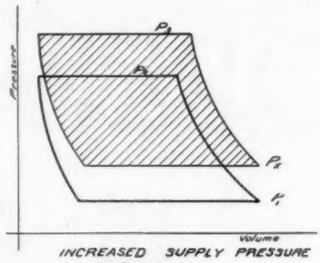
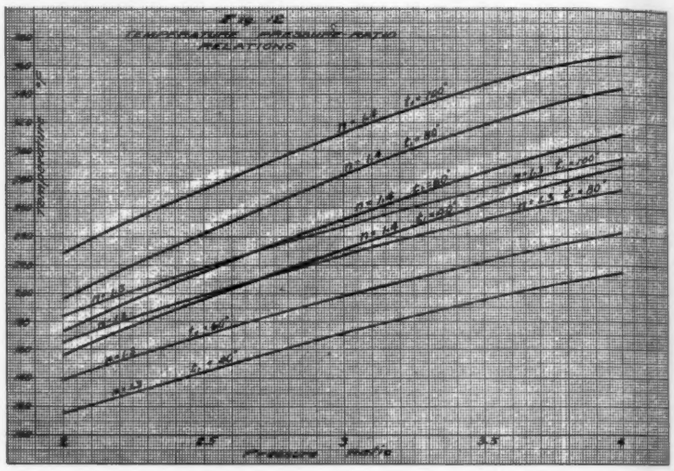


Figure 11

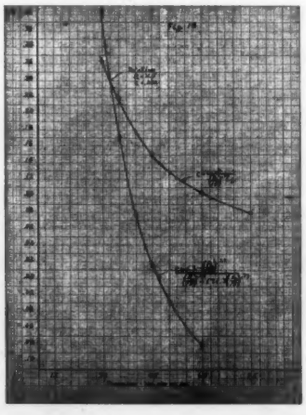
Development and Application of Formula 6

Figure 6 shows the effect of variations of the factors of Formula 6 on the work done.



Let it first be assumed that LPC = D or $E_v = 1$ and suppose there is no friction loss in the valves. The gas follows the line A B and $p_1 = p_2$. There is theoretical movement along A B but no work is done.

When the discharge pressure increases from p_1 to p_2, p_3, p_4, p_5 and p_6, the supply pressure remaining constant at p_1,



the re-expansion approaches the compression curve and the work done becomes zero when the discharge pressure is p_6, for which pressure the re-expansion curve follows the compression line. Between these two extreme discharge pressures p_1 and p_6 corresponding to no work, there is an intermediate discharge pressure giving a maximum area for the card, therefore maximum work conditions.

It is interesting to find a relation between pressure and volume at slightly below maximum work conditions. This permits finding the cycle for the design and construction of the compressor.

The maximum on any curve occurs when the derivative or slope of the curve equals zero.

By differentiating the mean effective pressure MEP with respect to the supply pressure P_1, the maximum of MEP will give the maximum work.

$$MEP = \frac{n}{n-1}P_1E_v\left[\left(\frac{P_2}{P_1}\right)^{\frac{n-1}{n}} - 1\right]$$

from Formula 5.

$$= \frac{n}{n-1}P_1\left[1 + c - c\left(\frac{P_2}{P_1}\right)^{\frac{1}{n}}\right]\left[\left(\frac{P_2}{P_1}\right)^{\frac{n-1}{n}} - 1\right]$$

by introducing Formula 6.

Developing this equation, setting P_2 as the constant and P_1 as the variable, differentiating and setting equal to zero,

$$\frac{d(MEP)}{d(P_1)} = \frac{1+c}{n}\left[\left(\frac{P_2}{P_1}\right)^{\frac{n-1}{n}} - n + \frac{n-1}{1+c}\left(\frac{P_2}{P_1}\right)^{\frac{1}{n}}c\right] = 0$$

And dividing by constants, the final expression is obtained:

$$(r)^{\frac{n-1}{n}} + \frac{n-1}{1+c}(r)^{\frac{1}{n}}c = n \quad (7)$$

(Continued on Next Page)

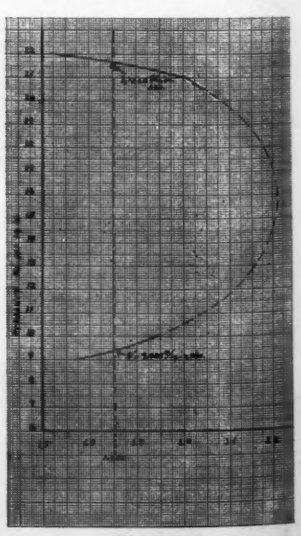


Figure 14

. . . . . *and an informative display of*

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where $r = \frac{P_2}{P_1}$ = ratio of pressures.

Equation 7 is solved by trial and error, giving the curve of Figure 7. Where the error curve intersects the zero error horizontal line, is found the solution for given values of c and n.

Methods in Use to Reduce the Indicated Work

Referring to Figure 8, let the area ABCD indicate the existing work conditions and P_2 P_2 be the compression curve at slightly below maximum work conditions.

Suppose that for a short period of time a pressure P_3 higher than P_2 is needed.

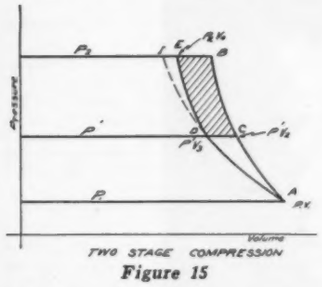


Figure 15

The new work will be represented by the area AEFG.

But it is possible that under an overload, the engine may burn up or stall, therefore some system must be used to cut down the extra work shown by the area BEFX.

Three systems are in use to reduce the work and prevent overloading the prime mover.

1. The work may be decreased by opening up clearance pockets at the end of the cylinder. Figure 8 shows the diagram obtained AHFK smaller than AEFG and Figure 9 shows the mechanical realization of the principle.

2. The work may be reduced by pinching the inlet or intake line of the compressor with a valve. The clearance remains the same. This method was tested by the author aided by Winston D. Burris and Karl O. Heintz in the mechanical engineering laboratory of the University of Oklahoma.

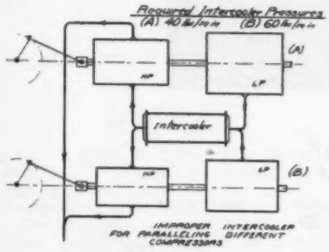


Figure 16

Figure 10 shows the supply pressure reduced by pinching the inlet valve from P_1 to P^1.

3. The work may be reduced by increasing the supply pressure. Figure 11 shows the new diagram obtained by raising the supply pressure from P_1 to P_x.

Pressure-Temperature Relations

By combining the two relations $P_1 V_1^n = P_2 V_2^n$ and $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$, it is found that:

$$\frac{P_2}{P_1} = \left(\frac{T_2}{T_1}\right)^{\frac{n}{n-1}} \qquad (8)$$

Figure 12 illustrates the pressure temperature relation derived from Formula (8). It is hoped that the curves presented may be of some use in determining the final temperatures to expect, when all other factors are known.

They should be used by interpolation between plotted values.

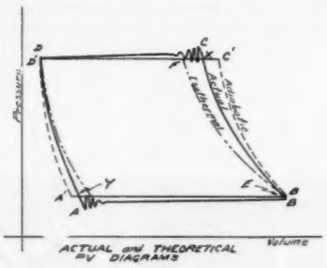


Figure 17

The theoretical pressure ratio may be found if T_1, T_2 and n are known. The value of n can be found if T_1, T_2 and $r = \frac{P_2}{P_1}$ are known. All temperatures are expressed from zero absolute Fahrenheit.

Problem Applying the Three Methods to Reduce the Indicated Work

Assuming D = cubic feet, $E_v = 0.80$, $n = 1.3$ and $P_1 = 15$ pounds per square inch absolute, operating at the discharge pressure existing when the load on the compressor is 80 per cent of maximum work, it is desired to calculate the following:

1. What will be the work per cycle under normal operating pressure ratios, at 80 per cent of maximum work?

2. Assuming that the compressor is loaded to maximum work discharge pressure conditions, by what volume must the clearance volume be increased to decrease the work to normal?

3. In the absence of clearance pockets, with the original clearance volume, when the pressure has been raised to a maximum P_2, to what pressure P^1 must the intake be pinched in order to give normal work conditions?

4. Under the same conditions as 3, to what pressure P_x must the supply pressure be raised to operate at normal work conditions?

Solutions

1. Introducing the data of the problem in Formulas 6 and 7 and solving for c, two expressions of c in function of P_2 are found:

From Formula 6

$$c = \frac{.2}{(P_2/15)^{.77} - 1} \qquad (a)$$

From Formula 7

$$c = \frac{1.3 - (P_2/15)^{.25}}{(P_2/15)^{.25} - 1.3 + .3(P_2/15)^{.77}} \qquad (b)$$

From the above values (a) and (b) of c, two curves are constructed with value of P_2, varying arbitrarily, as abscissae and corresponding values of c as ordinates.

The point at which the curves intersect gives the co-ordinates assuring maximum work conditions.

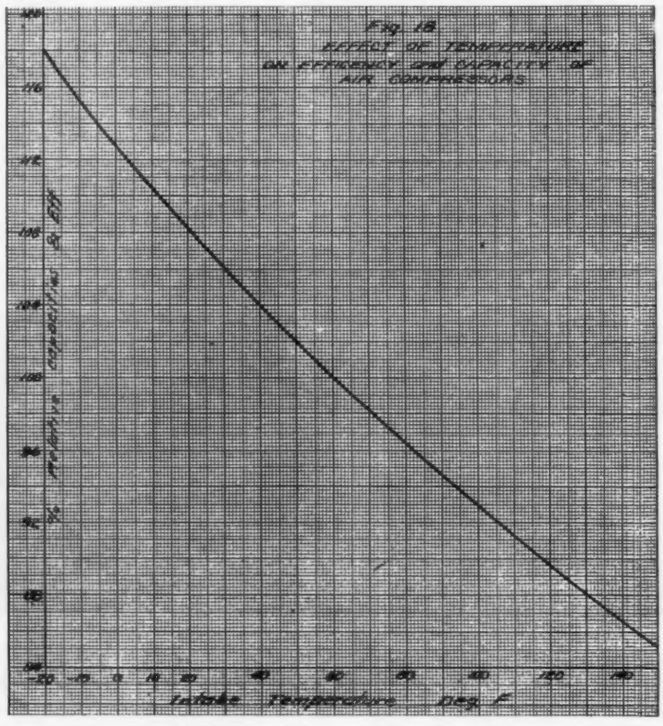
By reading Figure 13, it is found that $P_1 = 31.5$ pounds per square inch and $c = .262$.

The maximum work per cycle is obtained by using Formula 5.

$$W_{max} = 144 \times 15 \times .8 \times 10 \times 1.3/.3[(31.5/15)^{.25} - 1] = 14{,}000 \text{ foot lbs.}$$

The work per cycle, under normal operating conditions of 80 per cent of maximum work,

$$W = .8 \times 14{,}000 = 11{,}200 \text{ ft. lbs.}$$



2. With $P_2 = 31.5$ pounds per square inch, to decrease the work to normal, the clearance volume can be increased.

Introducing the constants of the problem and the expression for E_v given by Formula 6 into the work Formula 5,

$$W = 11{,}200 = 144 \times 15 \times [1 + c - (31.5/15)^{.77} c] \times 10 \times 1.3/.3[(31.5/15)^{.25} - 1]$$

and solving for c gives,

$$c = 0.454$$

The increase of c over the value found in Problem 1 = 0.454 — 0.262 = 0.192 and the increase of clearance volume

$$cD = 10 \times .192 = 1.92 \text{ cu. ft.}$$

3. Assuming $c = 0.262$ and $P_2 = 31.5$ pounds per square inch, calculate the supply pressure p^1 which will give normal work by pinching the intake valve.

$$W = 11{,}200 = 144P^1 \times 1.3/.3 \times 10 \times [1 + .262 - .262(31.5/P^1)^{.77}] \times [(31.5/P^1)^{.25} - 1]$$

The development of this equation gives

$$1.855 = P^1[1.262 - 3.72/(P^1)^{.77}] \times [2.221/(P^1)^{.25} - 1]$$

By constructing a curve in which the abscissa is maintained in the neighborhood of 1.855 and the ordinates represent the corresponding values of P^1, a satisfactory value of P^1 smaller than 15 pounds per square inch will be found corresponding to an abscissa of 1.855.

Figure 14 shows the solution: $P^1 = 9.425$ pounds per square inch.

4. Under the same assumptions as (3), it is desired to find a supply pressure P_x greater than P_1 and giving normal work conditions. The curve obtained under (3) passes by a point of maximum abscissa, after which the ordinates continue to increase as the abscissae decrease. P_x is found at the point where the curve intersects the vertical line passing through the abscissa of 1.855.

Figure 14 shows the solution: $P_x = 21.5$ pounds per square inch.

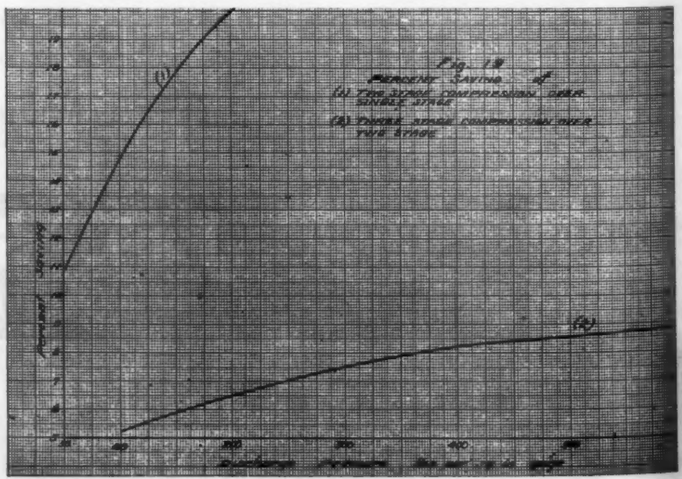
Multiple Stage Compression

It has been seen (Formula 8) that the temperature ratio is an exponential function of the pressure ratio. If the pressure ratios are allowed to exceed certain values (3.5 to 4) the temperatures soon become too high and the machine will wear faster due to the vaporization of lub oil.

To avoid thus reducing the general efficiency of the machine, multiple stage compression is used, with the purpose of approaching the ideal, isothermal compression.

Referring to Figure 15, assume A to be the state at the beginning of the compression and that path AB is practically adiabatic even though jacket cooling is used. AF is the theoretical isothermal compression line which it is desired to approach.

In multistage compression, the air follows path AB to some intermediate pressure P^1 at C and is discharged and cooled at constant pressure along CD in a wa-



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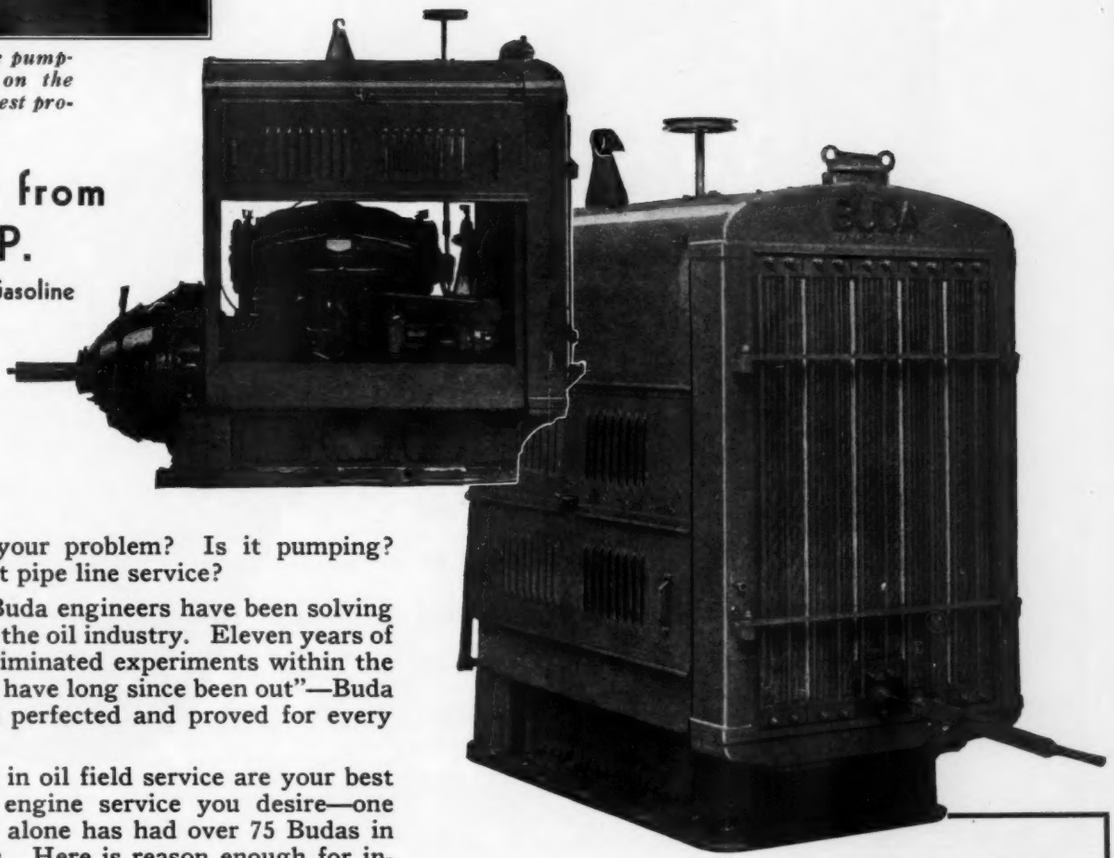

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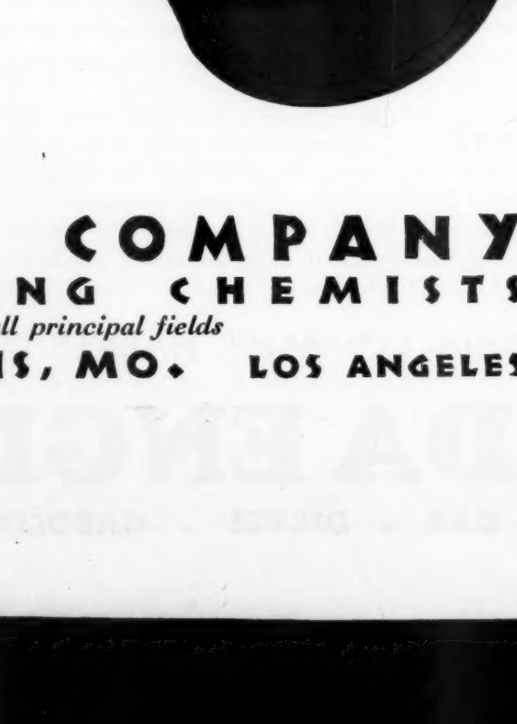

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ter cooled intercooler until the temperature of the air is approximately the same as when it was first admitted to the low pressure cylinder.

The air then enters the second cylinder where it is practically adiabatically compressed along DE and discharged along EI at the pressure P_2.

The work saved by two-stage compression is represented by the shaded area BCDE. Along with the saving of work, two, three and four-stage compression has other advantages over single stage compression, such as reduction in compressor stresses, lower temperature ranges and greater thermodynamical efficiency.

The intercooler should always be placed below the cylinder so that the water of condensation flows away from the cylinders.

Double Stage Compression. Best Intercooler Pressure. Work Formulae

Referring to Figure 15, the network is obtained by considering each stage as a separate compressor:

$$W_{net} = W_1 + W_2 = 144(n/n-1)P_1V_1[(P^1/P_1)^{n-1/n}-1] + 144(n/n-1)P^1V_2[(P_2/P^1)^{n-1/n}-1]$$

but $P_1V_1 = P^1V_2$ because of Boyle's law, the gas having been cooled back, in the intercooler to its initial temperature in the state P_1V_1.

$$\text{Therefore } W_{net} = 144P_1V_1(n/n-1)[(P^1/P_1)^{n-1/n} + (P_2P^1)^{n-1/n} - 2] \quad (9)$$

The minimum work conditions for maximum amount of work is found by differentiating equation (9) with respect to the intercooler pressure P^1 and solving for P^1. The best results will be obtained when equilibrium is attained, that is when the areas of the low pressure and high pressure diagrams are the same.

Differentiating and setting equal to zero gives:

$$dW/dP^1 = (n-1/n)[(P^1)^{-1/n}/(P_1)^{n-1/n}] + (1-n/n)[(P^1)^{1-2n/n}(P_2)^{n-1/n}] = 0$$

Developing and solving for P^1 gives the best intercooler pressure:

$$P^1 = \sqrt{P_1P_2} \quad (10)$$

Substituting in (9) the value of P^1 given by (10), results, after development, in the following formula:

$$W_{net} = 288\,P_1V_1(n/n-1)\times[(P_2/P_1)^{n-1/2n}-1] \quad (11)$$

Errors in Use of Intercoolers

Figure 16 illustrates the error of using a common intercooler for two machines of different rating.

Compressor A discharged at 40 pounds per square inch into the intercooler. Compressor B, constructed to discharge into the intercooler at 60 pounds per square inch was hooked in parallel with compressor A on a well which was on gas lift. A common intercooler was used for both machines.

A series of efficiency tests showed that compressor B failed to do the work its manufacturer claimed. The reason for this discrepancy is simple. Due to the construction of compressor B, the low pressure cylinder had to compress the gas to 60 pounds per square inch so as to fit the high pressure cylinder exactly. But compressor A was discharging into the intercooler at 40 pounds per square inch. Therefore B was operating at an excess of 20 pounds per square inch and was recycling gas toward A. In other words, B was doing work for A. The efficiency of A was apparently increased, that of B decreased.

When machines of different characteristics are being used on the same job, separate intercoolers must be provided and must be placed below the cylinders.

Advantage of Multistage Compression Over Single Stage Compression

Figure 17 shows an actual single stage diagram compared to theoretical diagrams and the curves of Figure 19, drawn from data furnished by the Ingersoll-Rand Co. show the per cent saving of two-stage compression over one-stage and of three-stage over two-stage, in function of the discharge pressure.

Effect of Temperature on Efficiency and Capacity of Air Compressors

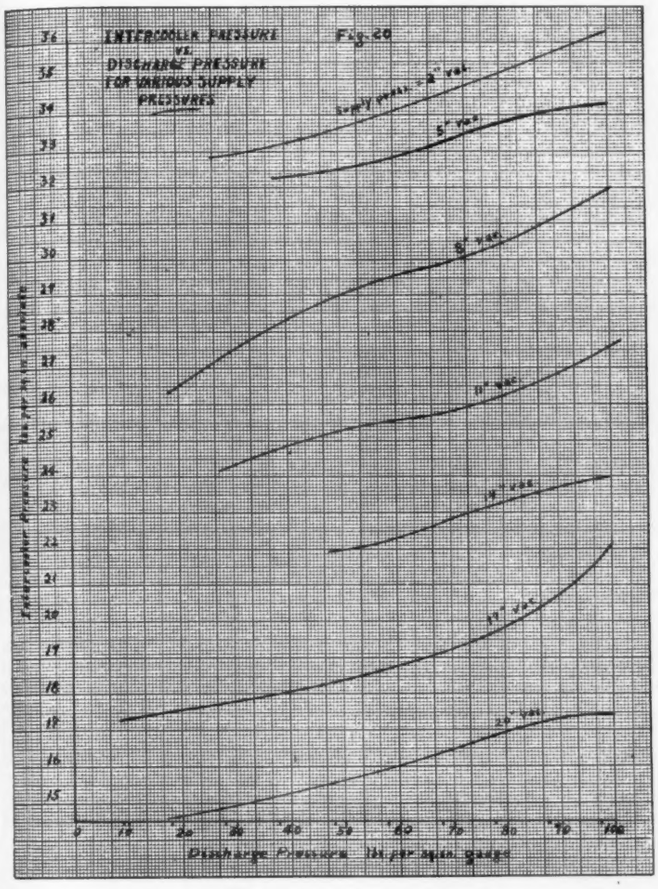
Figure 18 is drawn from data furnished by the Ingersoll-Rand Co. and shows that higher temperatures tend to reduce efficiency and capacity. The relative capacity and efficiency at 60° F. is taken as one, to serve as a comparison.

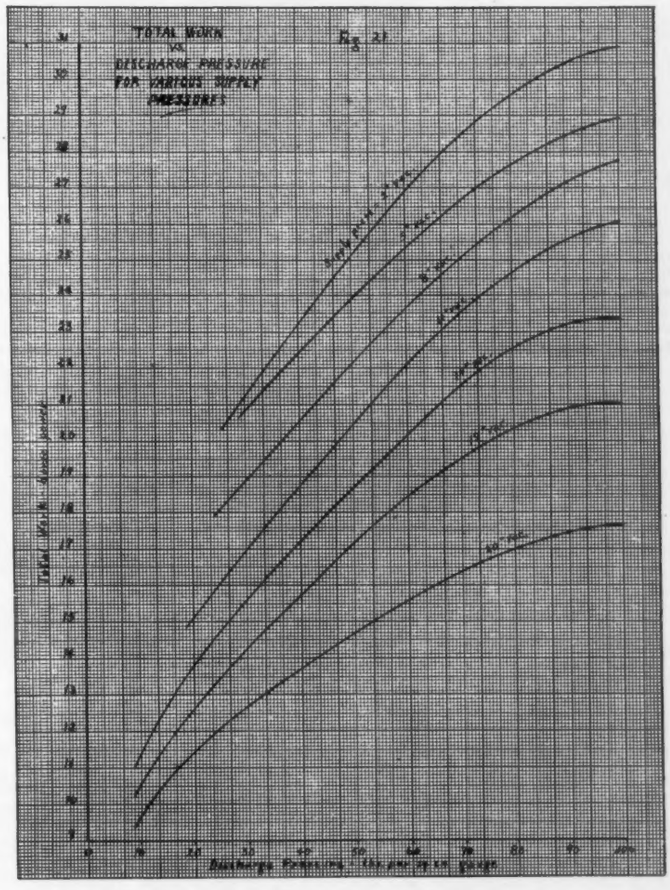
Experiments Conducted in the Mechanical Engineering Laboratories of the University of Oklahoma

The object of these experiments was to determine the operating characteristics of an air compressor under reduced supply pressure.

The machine tested was an Ingersoll-Rand Imperial Type XPVR steam driven cross compound two-stage air compressor with intercooler of the following dimensions: Steam cylinder, low pressure side 12"x10", high pressure side 7½"x10"; air cylinder, low pressure side 11"x10", high pressure side 7"x10".

The author was helped in the work by Winston D. Burris and Karl O. Heintz, graduate students in mechanical engineering. Much valuable advice was given by Prof. William H. Carson, director, and from Prof. Eugene F. Dawson, assistant professor of the department of mechanical engineering at the University of Oklahoma.





Discussion of Results

Figures 20, 21, 22, 23 and 24 show the results obtained in 64 different tests, involving 700 data, 130 indicator cards and 600 calculations.

Figure 20 shows the variation of the intercooler pressure in function of the discharge pressure when the supply pressure varies between 2 and 20 inches of vacuum.

Figure 21 shows the total horsepower in function of the discharge pressure for various supply pressures below atmospheric pressure.

Figure 22 shows the volumes flowing in cubic feet per minute, corrected to standard atmospheric conditions, in function of the discharge pressure, for various supply pressures below atmospheric pressure.

Figure 23 shows the horsepower per cubic foot low pressure capacity, corrected to standard atmospheric conditions, in function of the discharge pressure, for various supply pressures below atmospheric pressures. These curves are compared with reference curves showing work per cubic foot for atmospheric intake, and the following conditions: (1) Isothermal, (2) adiabatic, (3) adiabatic plus 15 per cent friction. The reference curves are obtained from data furnished by the Ingersoll-Rand Co.

Figure 24 shows the pressure ratios both on the high pressure and low pressure cylinders plotted against the discharge pressure, for various supply pressures below atmospheric pressure.

Due to changing temperatures, absence of a constant heat balance for the machine, calibration of instruments, relative accuracy of readings, cleaning out of the intercooler during the experiment and changing atmospheric conditions, some of the data do not fit the curves drawn. But an engineering curve is supposed to represent a trend and not necessarily a rigorous mathematical exactitude. The curves here presented represent averages and no claim is made for perfect mathematical accuracy.

Procedure

A vacuum gauge was installed below a valve placed in the intake line, all gauges were calibrated and readings corrected accordingly.

It was found possible to reduce the supply pressure to 27 inches of vacuum but no volumetric readings could be obtained at such low pressures.

The air discharged from the high pressure cylinder escaped into a tank upon which the pressure could be regulated by a valve, in order to have a range of discharge pressures.

The air from this tank escaped into

a standard receiver provided with a 2-inch nozzle. The volumes flowing were measured by the formula adopted by the compressed air society, corrected to standard atmospheric conditions of 14.7 pounds per square inch and 60° F.

$$Q = \frac{506\,P}{\sqrt{T}}\sqrt{\frac{H}{P_m}}$$

where

Q = cubic feet of air flowing measured at standard atmospheric conditions.

T = absolute temperature of air entering the nozzle.

P = observed barometric pressure in pounds per square inch.

P_m = absolute mean pressure between entering and leaving sides of nozzle, in pounds per square inch.

H = observed water column in inches of water, expressing receiver differential pressure.

506 = a coefficient taking care of all constants for the apparatus.

The work done was calculated by measuring the areas of the indicator diagrams for the head end and crank end of each cylinder.

$$HP = \frac{PLAN}{33{,}000}$$

where

HP = total horsepower.

P = mean effective pressure in pounds per square foot.

L = length of piston stroke in feet.

A = area of piston in square feet.

N = number of revolutions per minute = 200.

33,000 = feet pounds per minute for 1 horsepower.

After the supply pressure had been fixed, say at 20 inches of vacuum, by throttling the intake valve, the discharge pressure was made to vary from 100 pounds per square inch to atmospheric, by increments of 10 pounds per square inch. Intervals of 20 minutes were allowed between successive readings. The supply pressure was then changed to another vacuum and the readings made as before. Supply pressures were increased 3 inches at a time from 20 to 2 inches of vacuum.

Leading Conclusions

From the results, formulae, diagrams and curves included in this paper, it is possible to draw the following conclusions:

1. A method has been devised for determining the value of n in the compression formula for nonisothermal transformations, when the indicator cards are available.

2. Multistage compression represents a considerable saving over single stage compression for high discharge pressures and it is desirable to approach isothermal conditions as far as possible by increasing cooling efficiency, particularly on the high presssure side.

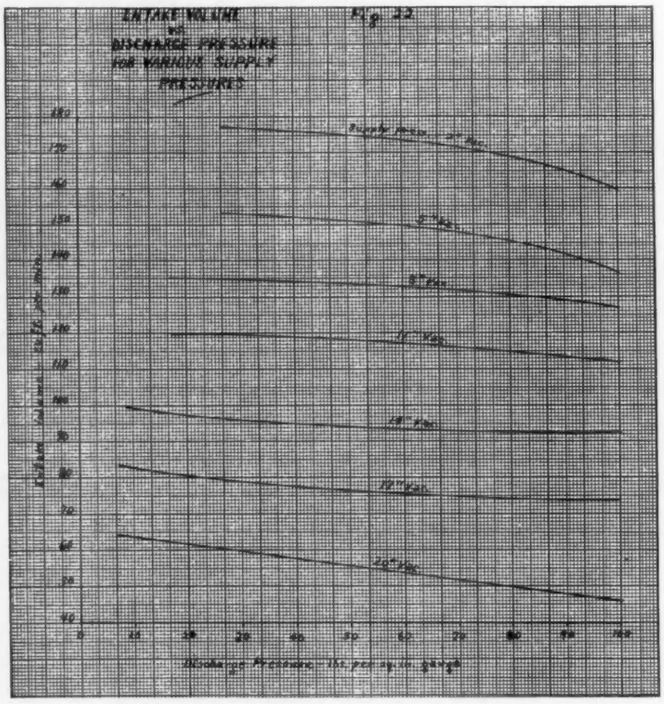
3. The danger of overheating and possible explosions occur on the high pressure side.

4. Relative capacities and efficiencies decrease as the temperatures increase.

5. The total work increases as the discharge pressure increases, and decreases as the supply pressure decreases below atmospheric pressure.

6. Volumes flowing decrease rapidly as the intake pressure is reduced below atmospheric pressure. These volumes decrease when the discharge pressure increases.

7. The work per cubic foot low pressure capacity increases rapidly when the intake pressure is reduced below atmospheric pressure and when the discharge pressure increases.



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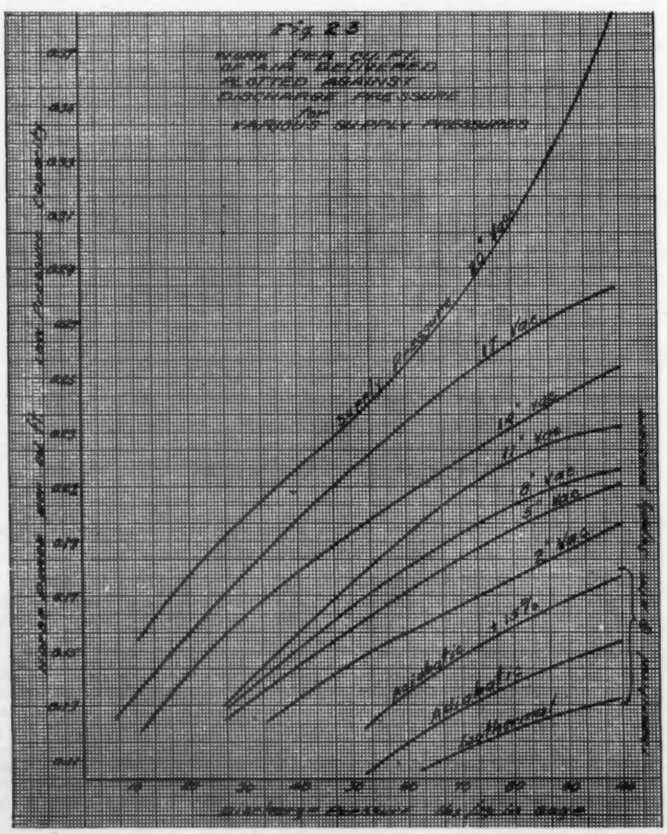
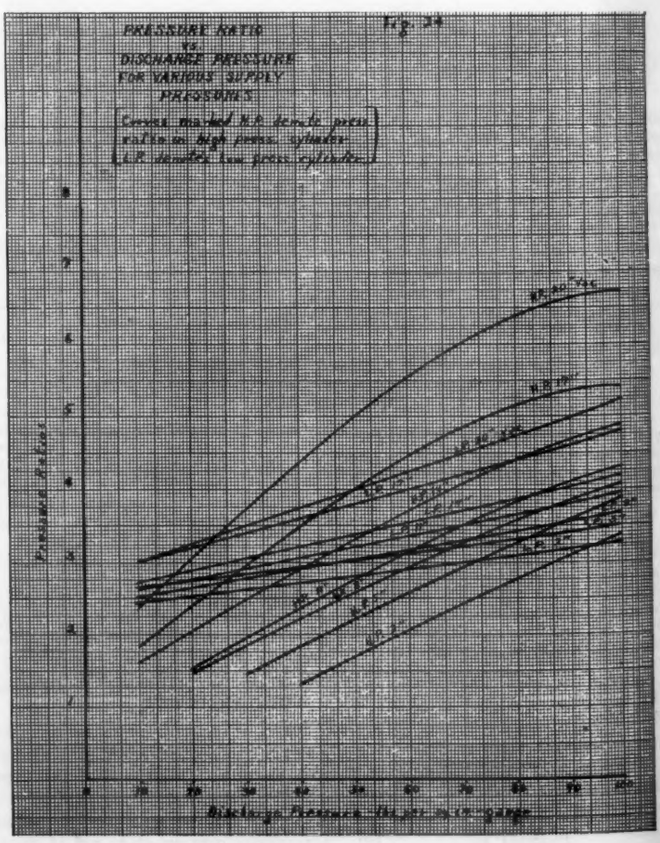
CONSOLIDATED OIL GETS PROXIES

The management of the Consolidated Oil Corp. reports it has received proxies representing more than a majority of the stock outstanding for the annual meeting, which will be held on May 16.





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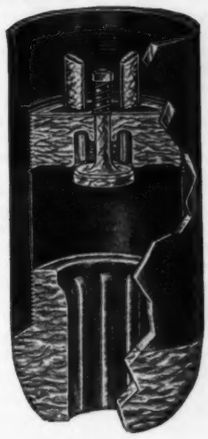

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Design of Radiant Absorption Section Pipe Still Coils Fired With Oil or Gas Fuel With Air

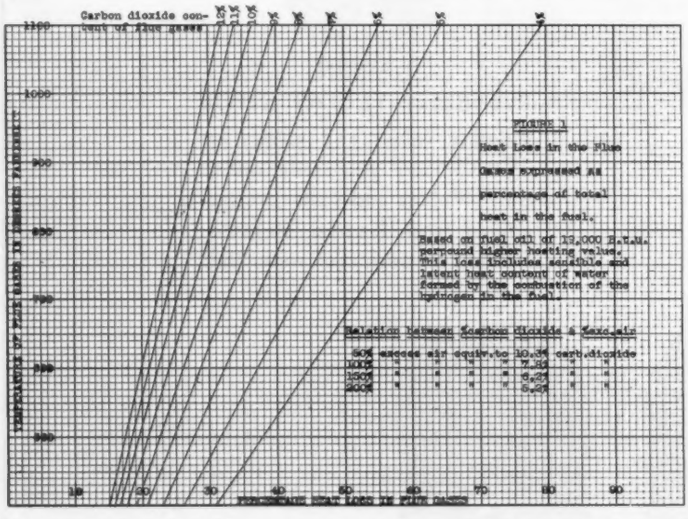
By CHARLES E. McCULLOCH
Foster Wheeler Corp.*

The design of radiant heat absorbing sections of pipe still coils has developed on an empirical basis. The limitations of the purely theoretical concept of radiant heat transfer are familiar to all pipe still designers and have been pointed out recently in the literature.

It is therefore thought to be of interest to outline a method for designing the radiant heat absorbing sections of pipe still coils which has been used with reasonable success for the last few years.

This paper is confined to the design of pipe still coils which are fired with oil or gas fuel with air for combustion supplied at atmospheric temperature and in which flue gas recirculation is not used. This includes the great majority of pipe still coils now used in oil refinery and industrial service.

The data presented is based upon combustion in the furnace with approximately 50 per cent excess air. This has proven to be an amply conservative basis of design for the reason that very few furnaces are fired with less than 50 per cent excess air in actual operation and because firing with more than 50 per cent excess air makes for milder furnace conditions and lower transfer rates to the coil than are contemplated in the design.


Carbon dioxide content of flue gases
Temperature of flue gases in degrees Fahrenheit
Radiant Heat Loss in Flue Gases
Heat Loss in the Flue Gases expressed as percentage of total heat in the fuel.
Based on fuel gas of 23,000 B.t.u. per cubic foot higher heating value. This loss includes sensible and latent heat content of water formed by the combustion of the hydrogen in the fuel.
Relation between carbon dioxide & excess air
50% excess air equiv. to 10.5% carb. dioxide
100% " " " " 7.5% " "
150% " " " " 6.0% " "
200% " " " " 5.0% " "

The general method of design may be divided into three steps as follows:

1. The overall fuel efficiency to be obtained in the actual operation of the coil being specified determine the temperature to which flue gases must be cooled before leaving the heater.
2. Determine the maximum allowable rate at which heat may be transferred to the coil.
3. Determine the proportion of the total heat absorbed by the entire coil (radiant plus convection sections) which is to be absorbed by the radiant heat absorbing surface.

To Determine the Temperature of Flue Gases Leaving the Heater

In order to accurately determine the relationship between fuel efficiency and temperature of the combustion gases leaving the heater, it is advisable to have available an analysis of the fuel particularly in the case of heaters fired with gas fuel. This information is generally not available to the pipe still designer for various reasons. It is therefore necessary to base the design of the coil on representative gas or oil fuel.

Figures 1 and 2 show the relationship between per cent carbon dioxide in the flue gases, temperature of the gases and percentage of total heat in the fuel lost up the stack for typical oil and gas fuels.

Figure 1 is based upon an average fuel oil having a higher heating value of 19,000 B.t.u. per pound and an assumed chemical analysis of 88 per cent by weight carbon and 12 per cent by weight hydrogen. This same curve may be used also for fuels varying in heating value between 18,500 and 19,500 B.t.u. per pound without introducing appreciable error.

Figure 2 is based upon a natural gas having a higher heating value of 940 B.t.u. per cubic foot at 60° F. and 30" mercury and saturated with water vapor. This same chart may be used for fuel gases ranging in heating value between 600 and 1,500 B.t.u. per cubic foot provided that the molal ratio of hydrogen to carbon in the fuels is approximately 2:1.

It is general practice to arbitrarily assume 5 per cent radiation and convection loss from the brick setting. Thus the overall heater efficiency is calculated as the difference between 100 and the percentage heat loss shown on either Figure 1 or 2 increased by 5 per cent to allow for loss from the setting.

To Determine Maximum Rates of Heat Transfer to Coil

The maximum allowable rate of heat transfer to the coil is naturally dependent upon the rate at which the circulating oil removes heat from the tube and the maximum temperature to which the tube may be heated without excessive corrosion, external oxidation or reduction in creep stress. These conditions are in turn controlled by such factors, (a) allowable oil velocities as fixed by allowable pressure drop, (b) tendency of the oil to overheat and deposit an insulating layer of coke on the inside of the tubes, and (c) tendency of oil, such as lubricating oils, to darken upon exposure to high temperature.

It is quite impossible to generalize regarding allowable rates of heat transfer to pipe coils because of the multitude of variables that enter into the problem. Certain types of heaters must be regarded as individual special cases. In this category we might list oil vapor superheaters in which vapor is raised in temperature from 750 to 1,000° F. with pressure drop limited to 10-20 pounds, or pipe still coils operating under vacuum in which mass velocity through tubes is reduced to a minimum in order to permit the vacuum to penetrate as far back into the coil as possible. There are numerous other cases which require special treatment. For this reason it is only possible to list a few types of heaters which are more or less generally used. Table 1 is a tabulation based on conservative design practice showing recommended transfer rates to the radiant section of pipe still coils for varying operating conditions. Also tabulated is the recommended velocity to be maintained to insure proper cooling of the tubes expressed as barrels per day of oil flow per square inch of cross sectional area of tube. These velocities are consistent with reasonable pressure drop. Pressure drop through topping heaters of average size will not exceed 150 pounds and pressure drop through cracking heaters of average size will not exceed 300 pounds.

TABLE 1

Type of service—	Transfer rates to radiant surface: Staggered two row	Transfer rates to radiant surface: One row	Oil velocity bbls./day/sq. in. (cold oil basis)
Topping heaters up to 600° F. (10-25% vapor)	10,000	13,000	400-450
Topping heaters up to 600° F. (25-60% vapor)	10,000	13,000	300-400
Topping heaters up to 800° F. (60-100% vapor)	9,000	11,700	250-300
Light oil cracking heaters up to 950° F.	8,500	11,000	500-700
Heavy oil cracking heaters up to 950° F.	8,000	10,500	600-800

The above transfer rates are expressed as B.t.u. per hour per square foot of all around external circumferential tube area.

The choice between radiant surface arrangement in single row or double row depends upon the operating requirements. The use of a shielded second row of tubes as offered by the two-row radiant tube construction permits the absorption of heat at relatively low rates which is particularly desirable in certain types of heaters among which might be mentioned:

(a) Light oil cracking heaters in which a definite soaking period at high temperature and low rates of heat input is required, and

(b) Heaters operating in conjunction with vacuum fractionating equipment in which heat is added at low rate to oil passing through the tube at relatively low mass velocities.

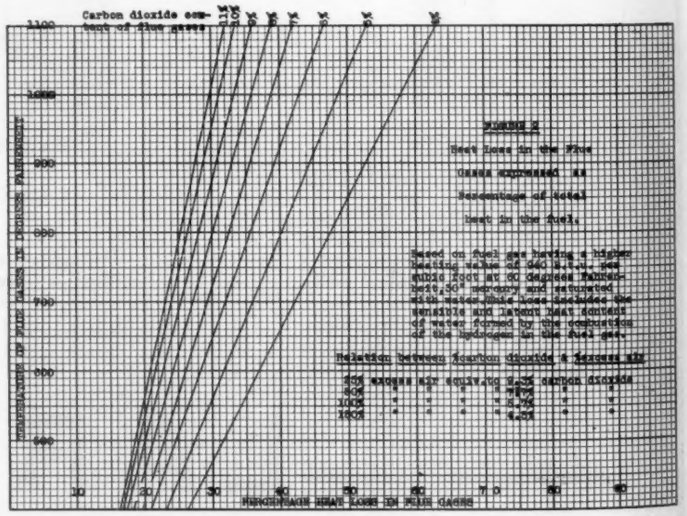
In the case of light oil cracking heaters, three and four-row radiant surface has been very successfully used on selected stocks as an alternative to providing the soaking time in a reaction chamber.

Single row radiant surface is particularly applicable to heavy oil cracking heaters in which it is desirable to bring the oil up to the highest possible temperature in the shortest time. Absorption of heat at low rates or the introduction of any soaking element after the oil has been brought up to cracking temperature causes rapid coke deposition with resultant short tube life and frequent shut down for cleaning.

Regarding Heat Distribution to Each of the Two Rows of a Two-Row Radiant Type Construction

It is extremely difficult, if not impossible, to determine the distribution of heat transferred to both the upper and lower row in a heater with two-row radiant tube type construction where there is vaporization in the coil. This difficulty arises from the fact that it is impossible to accurately determine the amount of heat added by vaporization in each section of the coil.

Experiments on certain specialty heaters such as asphalt or vegetable oil heaters used in industrial service have been more successful in this respect because all of the heat added is as sensible heat. This work shows that the lower row absorbs approximately 65 per cent of the total heat transferred to the two rows and the upper row approximately 35 per


Carbon dioxide content of flue gases
Temperature of flue gases in degrees Fahrenheit
Radiant Heat Loss in Flue Gases
Heat Loss in the Flue Gases expressed as percentage of total heat in the fuel.
Based on fuel gas having a higher heating value of 940 B.t.u. per cubic foot at 60 degrees Fahrenheit, 30" mercury and saturated with water vapor. This loss includes the sensible and latent heat content of water formed by the combustion of the hydrogen in the fuel gas.
Relation between carbon dioxide & excess air
50% excess air equiv. to 10.5% carbon dioxide
100% " " " " 7.5% " "
150% " " " " 6.0% " "
200% " " " " 5.0% " "

*Prepared for meeting, A.S.M.E., Tulsa.

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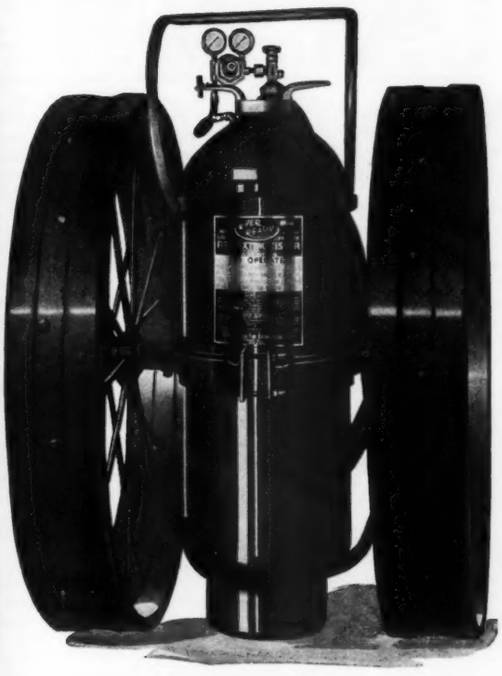

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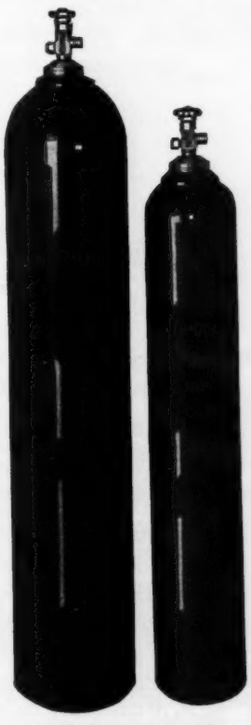
Dry Chemical Fire Engine

NUMBER 30
Dry Chemical Fire Extinguisher



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cent. (This with staggered two-row surface located in the roof of the furnace.)

Hottel's[1] work on this subject showed a somewhat greater proportion of heat absorbed in the lower row but this may be due to the fact that his experiments did not take into account the transfer of heat by forced convection from hot gases to the radiant heat elements. This factor cannot be overlooked in the conventional oil heater where the hot gases of combustion sweep over a bridge wall and come in direct contact with the radiant heat absorbing elements.

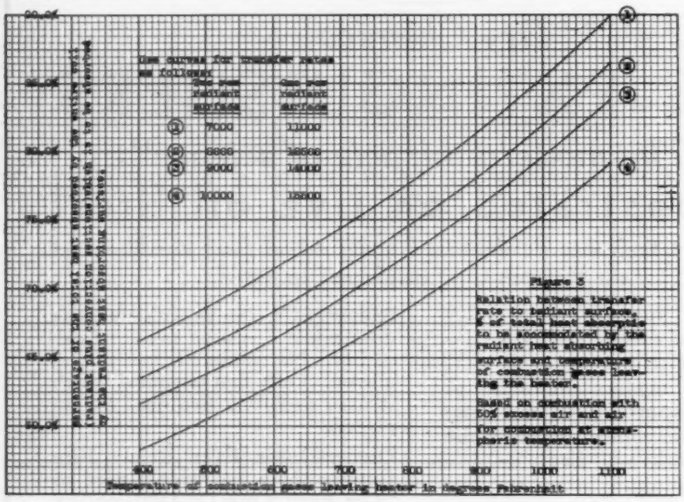


Figure 3
Relation between transfer rate to radiant surface, B of total heat absorbable to be accommodated by the radiant heat absorbing surface and temperature of combustion gases leaving the heater.
Based on combustion with 50% excess air and air for combustion at atmospheric temperature.
Temperature of combustion gases leaving heater in Degrees Fahrenheit

Regarding the Relative Effectiveness of Single-Row and Double-Row Radiant Heat Absorbing Surface

Experiments on furnaces having single-row radiant heat absorbing surface on the roof and floor as compared with furnaces having two-row radiant heat absorbing surface in the roof only have shown that approximately 155 square feet of two-row surface is required to equal the effectiveness of 100 square feet of surface arranged in single row.

Regarding Tube Material

Because oil and tube metal temperatures in the radiant section of pipe still coils are usually in excess of that encountered elsewhere in the coil it is of interest to outline the general practice regarding the various tube metals used for this service.

In cracking heaters up to 925-950° F. oil temperatures at 500 pounds pressure handling Mid-Continent crude and similar stocks where corrosion is not serious, carbon steel tubes have given entirely satisfactory service.

In reforming heaters handling noncorrosive stocks, operating at oil temperatures up to 1,025° F. and pressures up to 750 pounds, carbon steel tubes containing 0.5 per cent molybdenum with 0.20 per cent carbon maximum are giving good results, without excessive scaling due to external oxidation.

For oil temperatures up to 1,050° F. and pressures up to 500 pounds, alloy tubes containing 4 to 6 per cent chrome, 0.5 per cent molybdenum and 0.20 per cent carbon have given satisfactory service.

Stainless steel alloy tubes have been quite widely used for corrosion resistance and at metal temperatures beyond the range of the low chrome alloys.

To Determine the Proportion of the Total Heat Absorbed by the Entire Coil (Radiant Plus Convection Sections) Which Is to Be Absorbed by the Radiant Heat Absorbing Surface

Having determined the temperature to which flue gases must be cooled on leaving the heater, and having fixed the maximum allowable rates of heat transfer to the radiant heat absorbing section of the coil it is possible by the use of Figure 3 to read directly the proportion of the total heat absorbed by the entire coil (radiant plus convection sections) which is to be absorbed by the radiant heat absorbing surface.

Figure 4 shows the relation between transfer rate to the radiant heat absorbing surface and temperature of combustion gases leaving the radiant heat absorbing section of the furnace and entering the convection section of the coil. This curve may be used in determining the gas temperature entering the convection section of the coil for calculating the temperature difference between oil and gas at the hot end of the convection section.

Figures 3 and 4 are based on a definite relation between the total heat liberated in the furnace per square foot of radiant heat absorbing surface and the transfer rate to the radiant heat absorbing surface. This relation is as follows:

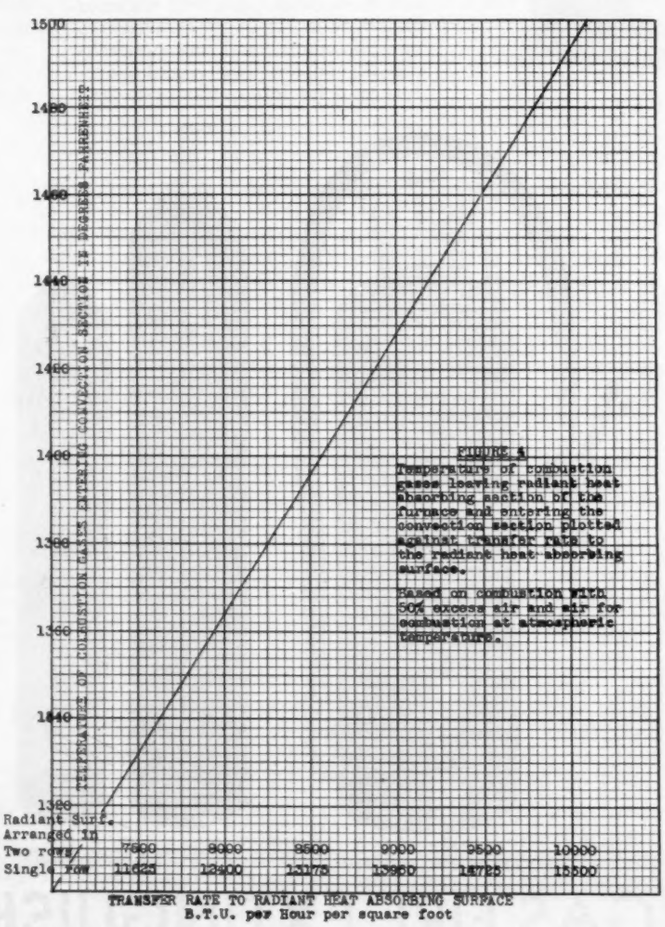
Liberation in furnace B.t.u./hr./sq. ft. R.H.A. surface	Transfer rate to R.H.A. surface B.t.u./hr./sq. ft. staggered two-row surface
14,000	7,000
16,500	8,000
19,000	9,000
21,500	10,000

Liberation in furnace B.t.u./hr./sq. ft. R.H.A. surface	Transfer rate to R.H.A. surface B.t.u./hr./sq. ft. one-row surface
22,000	11,000
25,800	12,500
29,500	14,000
33,000	15,500

The basis for Figures 3 and 4 is data collected on a wide variety of pipe still coils operating under widely varying conditions. It is the writer's belief that pipe still coils arranged with radiant heat absorbing surface in the amount recommended by these charts will permit satisfactory operation with long tube life and low furnace maintenance costs.

The data herein presented will be found of value in the design of the great majority of pipe still coils which are fired with approximately 50 per cent excess air in combustion and with air for combustion at atmospheric temperature. The data is not applicable to furnaces fired with preheated air or to furnaces in which flue gas recirculation is employed. For such special cases, the reader is referred to the paper of Wilson[2], Lobo and Hottel.

The design of the convection sections of pipe still coils is not within the scope of this paper but readers interested in this problem will find the work of Monrad[3] highly informative.


1500
1480
1460
1440
1420
1400
1380
1360
1340
1320
TEMPERATURE OF COMBUSTION GASES ENTERING CONVECTION SECTION IN DEGREES FAHRENHEIT
FIGURE 4
Temperature of combustion gases leaving radiant heat absorbing section of the furnace and entering the convection section plotted against transfer rate to the radiant heat absorbing surface.
Based on combustion with 50% excess air and air for combustion at atmospheric temperature.
Radiant Surf. Arranged in
Two rows/ 7500 9000 9500 9000 9500 10000
Single row 11625 12900 13275 13950 14725 15500
TRANSFER RATE TO RADIANT HEAT ABSORBING SURFACE
B.T.U. per Hour per square foot

[1] "Radiant Heat Transmission Between Surfaces Separated by Nonabsorbing Media," H. C. Hottel, Trans. A.S.M.E., Vol. 53 (1931), p. 265.

[2] "Heat Transmission in Radiant Sections of Tube Stills," D. W. Wilson, W. E. Lobo, H. C. Hottel, Ind. Eng. Chem., Vol. 24 (1932), p. 486.

[3] "Heat Transmission in Convection Sections of Pipe Stills," C. C. Monrad, Ind. Eng. Chem., Vol. 24 (1932), p. 505.

Oil Man Proposes Plan to Adjust Labor Issues

Stressing the urgent need to reduce as much as possible and as quickly as possible the wave of strikes that is sweeping the country, E. B. Lyman, a well known figure in New York petroleum circles, in an article of the current edition of "America," offers a four-point plan retaining the labor unions. He says:

"My own view is that industry and government might well study the possibility of combining the best features of employe representation and independent labor unions, with the Government in the role of a friendly court of appeals.

"We must recognize that employe representation, numerous as are its advantages and well as it has worked in many cases, has an inherent weakness in that it gives even the conscientious employer at least a psychological advantage, because employe representatives are necessarily dependent upon him for their jobs. A universal system of labor unions covering all industry, as the only machinery for collective bargaining and without safeguards against abuse or provision for direct negotiation between employer and employe, is not the answer either. To my mind, not only would such a system be based on the false philosophy of conflict already mentioned, but it would invest labor with the same autocratic power which we have long condemned in capital. Human nature is human nature, whether it wears overalls or a silk hat.

"Very roughly, such a plan might function something like this:

"1. Where workers desire to bargain collectively with their employers through an employe-representation plan, such differences as are susceptible of settlement in this manner would be dealt with directly and amicably without intervention by a third party. Experience has shown that, whatever its faults, this system fairly applied imbues employers with a responsibility for the welfare of their employes beyond that which could be imposed by law.

"2. Questions which employers and employes are unable to settle directly, together with problems which, as Senator Wagner has aptly pointed out, transcend the boundaries of a single business, would be referred to the labor union of the industry in question—to which, as already mentioned, all workers would have the right to belong.

"3. Representatives of the labor union within a particular industry would have equal representation with spokesmen for management on what might be termed an industrial council. The purpose here would be to establish a check on abuses of company unions by affording the worker a sort of court of appeals outside his company, while at the same time retaining the advantage of direct negotiation and the better understanding between the individual worker and his 'boss' to be promoted thereby.

"4. Certain issues, of course, not only cut across company lines but involve all industry. These, together with problems on which our industrial councils were unable to reach an agreement, might go to a national arbitration board composed of representatives of management, labor, and Government. This would be a sort of supreme court for arbitration of disputes, and its effectiveness would of course depend on the experience and highmindedness of its members."

ROAD DIRECTIONS

A local oil man cut across the country, going to Jal, N. Mex. He got off the road over in Andrews County, and finally got to a desolate ranch house and asked an old fellow who lived alone how to get to Jal.

The rancher reflected. "Well, I believe I would go back about a mile, and take the first right hand road. No, I believe I would take the left hand road. Come to think of it, stranger, if I was trying to get to Jal, I wouldn't start from here at all."—Midland (Texas) Reporter-Telegram.

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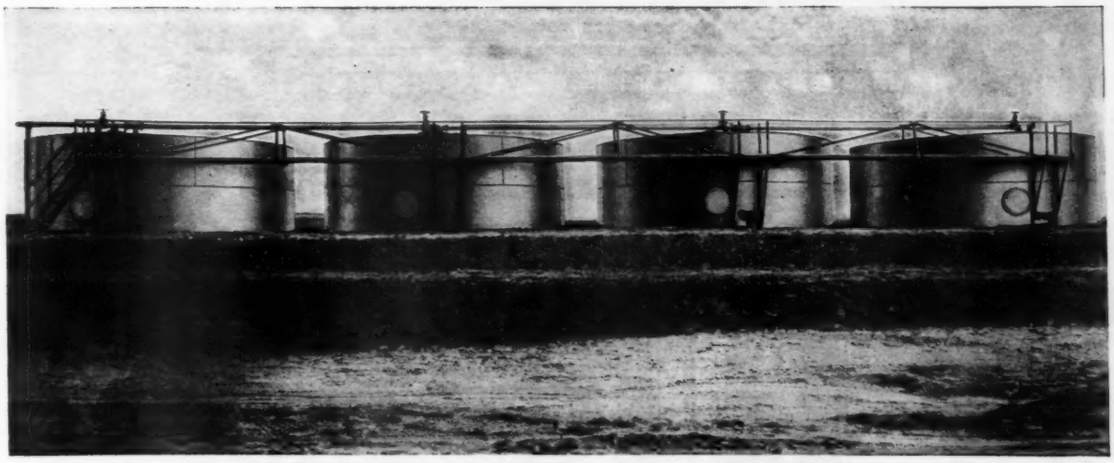

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FOR EVERY OIL INDUSTRY NEED

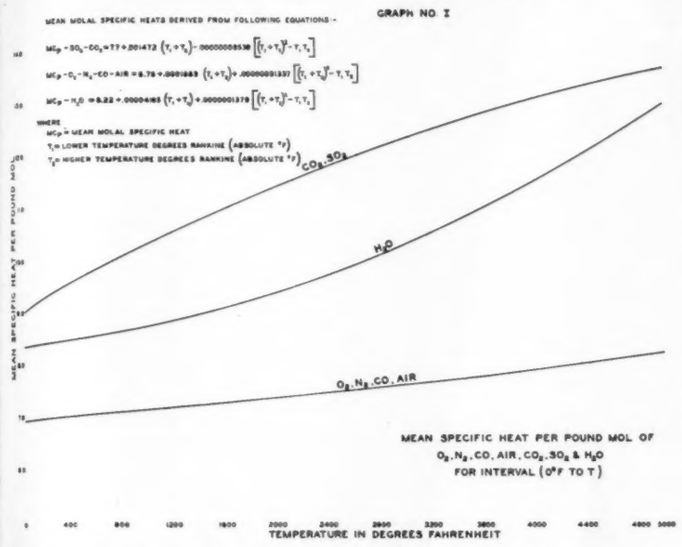
Molal Combustion and Graphical Representation of Stack Losses in Burning Petroleum Fuels

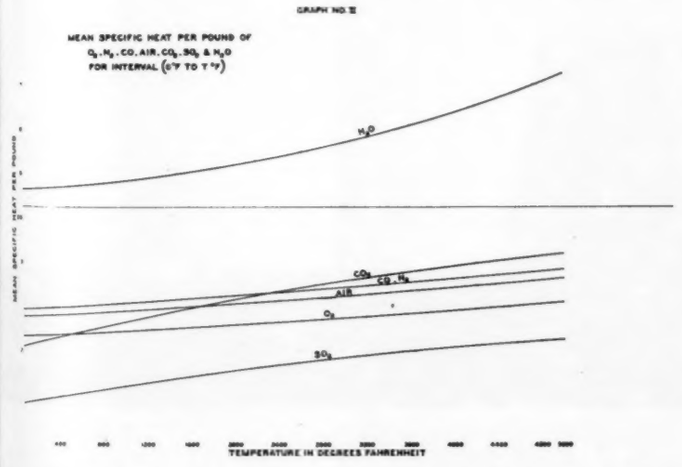
By O. F. CAMPBELL
Sinclair Refining Co.*

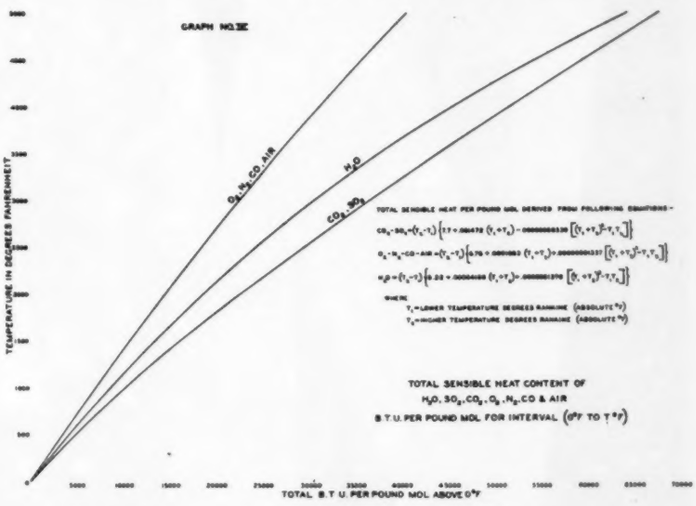
Efficiency in the burning of solid, liquid, or gaseous fuels is one of the major engineering problems of the present day. The quantities of the various kinds of fuels required for domestic and industrial uses are continually increasing and the quantity of fuel available is continually decreasing. History teaches us that our civilization is dependent on fuel and if our present civilization is to be maintained at its present level or a higher level it will be necessary to conserve our present fuel supply and in the future develop means of producing fuel. When our present fuel supply is exhausted and if enough fuel cannot be produced to meet the demand other methods must be developed to obtain heat. It is true our present fuel supply is enormous but eventually the supply will be exhausted and we must look elsewhere for our fuel supply.

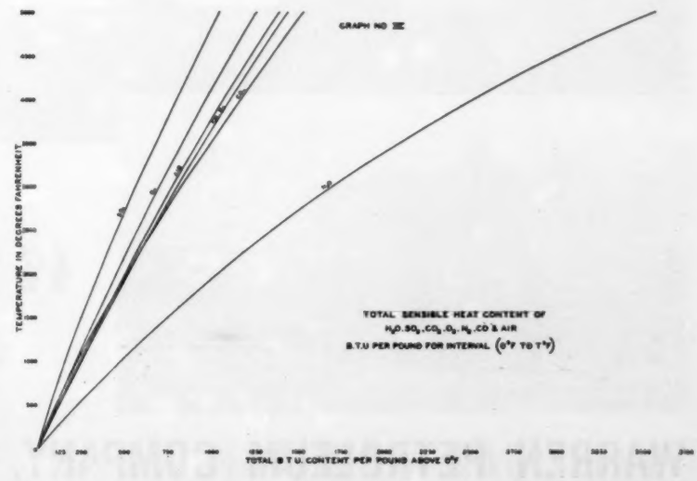
With the ever increasing demand for fuel and the gradual diminishing quantity of fuel available each fuel burning unit should operate as efficiently as possible. The price of fuel usually governs the efficiency of any fuel burning unit. The higher the fuel price the greater is the justification for heat recovery equipment such as air preheaters, economizers, and heat exchangers. Fuel oil prices in some localities have more than doubled during the past year and as a result air preheaters have been repaired and heat exchangers have been installed. High priced fuels eventually promote higher efficiency and less fuel consumption. During the past few years it has not been economical to install heat conserving equipment due to such ridiculously low priced fuels and there has been a wanton waste of fuel. It appears that if we desire to save fuel it is first necessary to raise the fuel prices.

The present administration has done much to conserve our fuel supply. Fuel prices have increased to the extent that heat recovery equipment can now be justified. With an increased demand for heat recovery equipment more men will be put to work in the manufacture of this equipment and unemployment will therefore be further reduced. The oil refineries at the present time are becoming more fuel minded due to their increased fuel cost per barrel of crude or per barrel of gasoline. As fuel prices continue to increase and fuel costs increase more and more attention will be given to fuel consumption and to heat recovery equipment. Fuel prices should never return to their chaotic state of the past few years if we desire to conserve our natural fuel supply. With increased fuel prices more attention must be given to the design of new equipment and to the fuel burning units already installed. New fuel burning units will unquestionably be more efficient than existing equipment and it is toward existing equipment that this paper is primarily directed. The main purpose of this paper is to set forth combustion data whereby the heat losses of existing equipment can readily be determined so that improvements may be made in order to conserve fuel. The data set forth in this paper will also serve as guide for designing new equipment.


GRAPH NO. I
MEAN MOLAL SPECIFIC HEATS DERIVED FROM FOLLOWING EQUATIONS -
WHERE
MC_p = MEAN MOLAL SPECIFIC HEAT
T_1 = LOWER TEMPERATURE DEGREES RANKINE (ABSOLUTE °F)
T_2 = HIGHER TEMPERATURE DEGREES RANKINE (ABSOLUTE °F)
CO_2, SO_2
H_2O
O_2, N_2, CO, AIR
MEAN SPECIFIC HEAT PER POUND MOL OF
$O_2, N_2, CO, AIR, CO_2, SO_2$ & H_2O
FOR INTERVAL (0°F TO T)
MEAN SPECIFIC HEAT PER POUND MOL
TEMPERATURE IN DEGREES FAHRENHEIT




GRAPH NO. III
O_2, N_2, CO, AIR
H_2O
CO_2, SO_2
TOTAL SENSIBLE HEAT CONTENT OF
$H_2O, SO_2, CO_2, O_2, N_2, CO$ & AIR
B.T.U. PER POUND MOL FOR INTERVAL (0°F TO T°F)
TEMPERATURE IN DEGREES FAHRENHEIT
TOTAL B.T.U. PER POUND MOL ABOVE 0°F

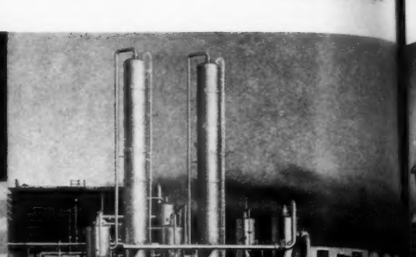

GRAPH NO. IV
TOTAL SENSIBLE HEAT CONTENT OF
$H_2O, SO_2, CO_2, O_2, N_2, CO$ & AIR
B.T.U PER POUND FOR INTERVAL (0°F TO T°F)
TEMPERATURE IN DEGREES FAHRENHEIT
TOTAL B.T.U. CONTENT PER POUND ABOVE 0°F

The Chemistry of Combustion

The chemistry of combustion as applied to furnaces encountered in oil refinery practice is elementary but for proper understanding of the subject for all concerned it seems advisable to include a brief discussion of the problems involved. Fuels are generally classified into three classes, namely, (1) solid, (2) liquid, and (3) gaseous. The solid fuels include coal, lignite, wood, peat, charcoal, coke oven coke and petroleum coke. The liquid fuels include liquid petroleum products, alcohols, and products from the destructive distillation of coal. The main gaseous fuels include coke oven gas, producer gas, water gas, refinery gas and natural gas.

Combustion for all practical purposes is generally accepted as a chemical reaction of carbon, hydrogen, sulphur, or their compounds with oxygen. From a standpoint of heat production for generating steam or other heating purposes combustion may be defined as the rapid combination of the combustible elements of any fuel with oxygen. The smallest quantity of an element of a compound that is capable of separate existence which may be accepted for combustion calculations as a physical unit of matter is called a molecule. Molecules are usually composed of atoms of elements. An atom may be defined as the smallest unit of an element which may enter into or be expelled from a compound. Molecules

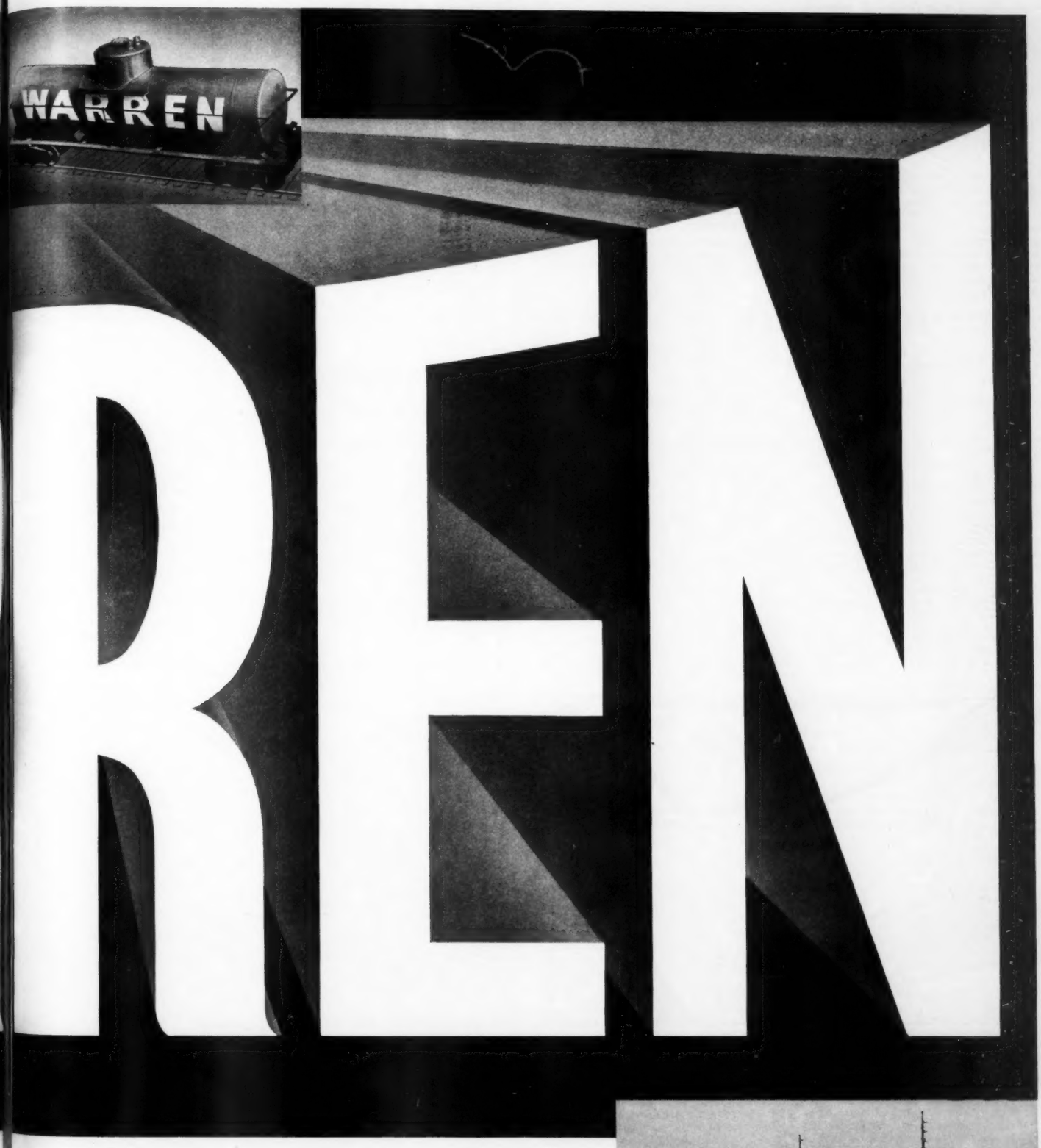
*Before Petroleum Division, A.S.M.E., Tulsa.



WAR

"JUST NATUR

WARREN PETROLEUM COMPANY, TULSA, OKLAHOMA • REFINERS,



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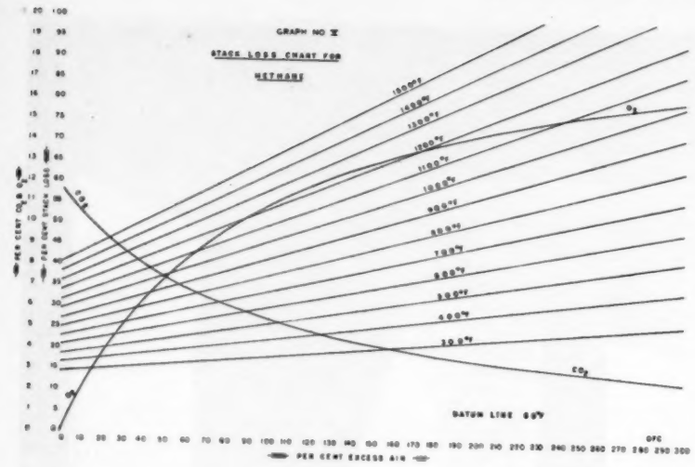
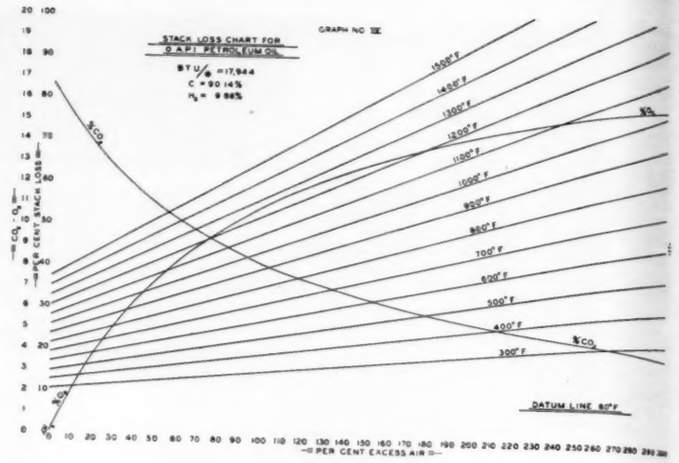
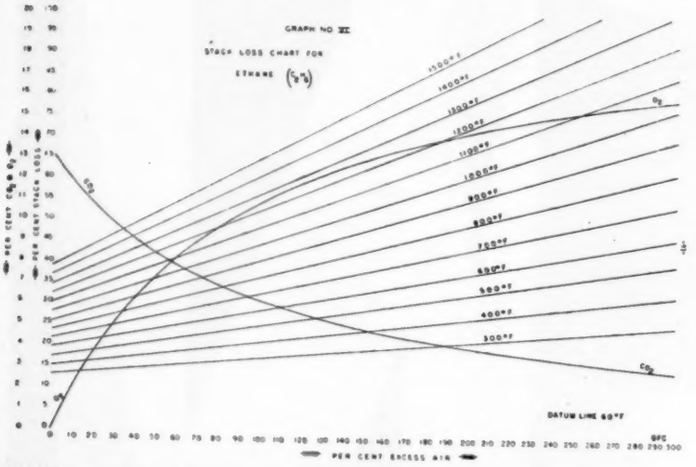
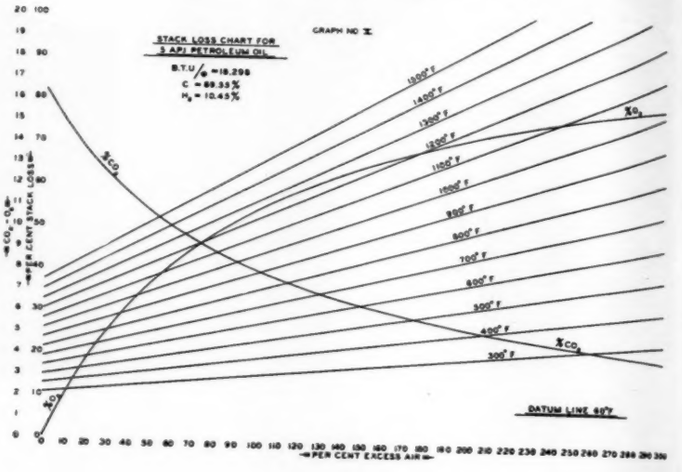
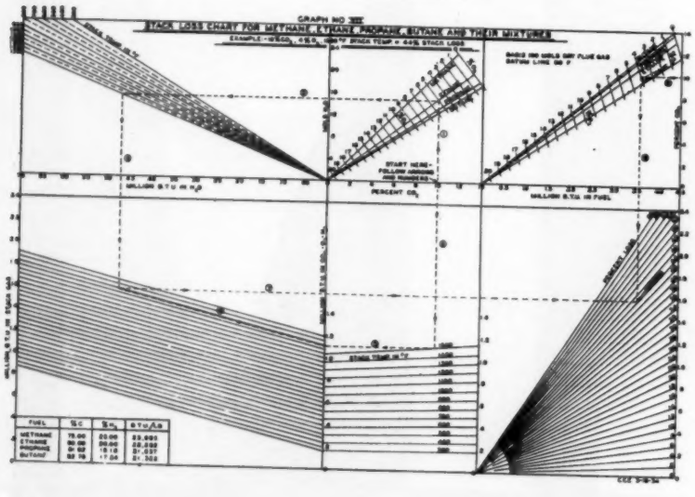
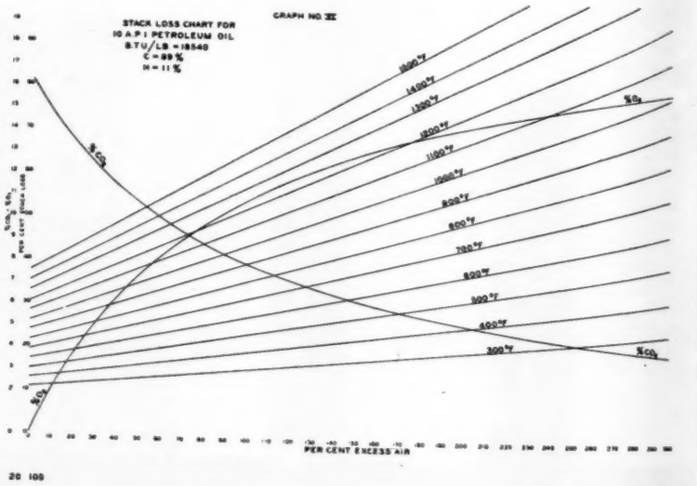

GRAPH NO I
STACK LOSS CHART FOR
METHANE
DATUM LINE 60°F
PER CENT EXCESS AIR

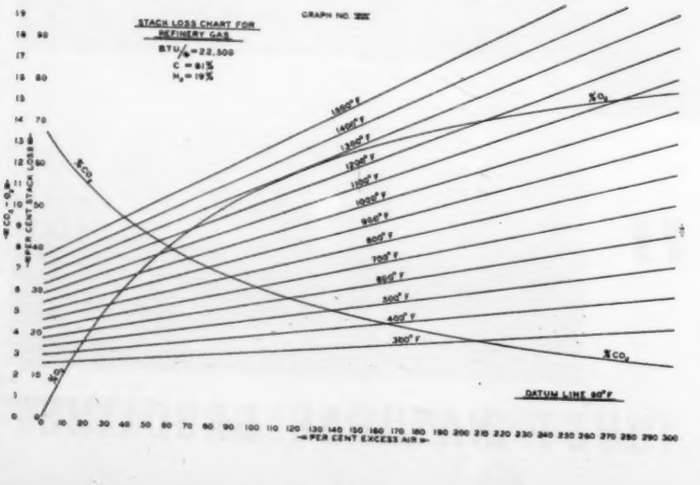

GRAPH NO II
STACK LOSS CHART FOR
0 A.P.I. PETROLEUM OIL
B.T.U./lb. = 17,944
C = 90.14%
H2 = 9.86%
DATUM LINE 60°F
PER CENT EXCESS AIR

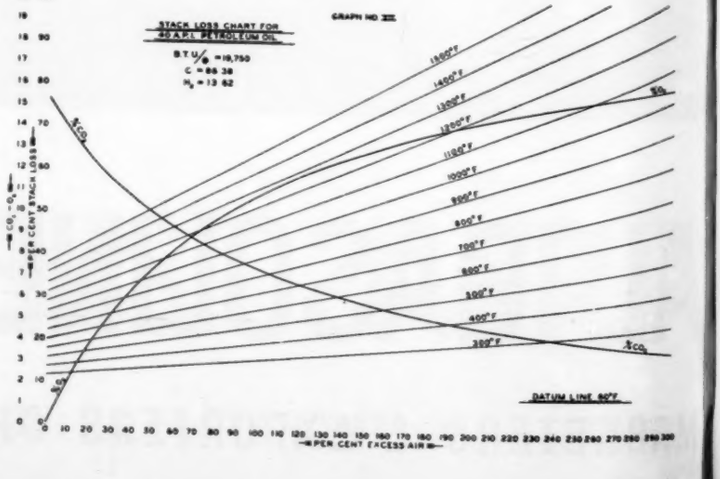

GRAPH NO III
STACK LOSS CHART FOR
ETHANE (C2H6)
DATUM LINE 60°F
PER CENT EXCESS AIR


GRAPH NO IV
STACK LOSS CHART FOR
3 A.P.I. PETROLEUM OIL
B.T.U./lb. = 18,298
C = 89.55%
H2 = 10.45%
DATUM LINE 60°F
PER CENT EXCESS AIR


GRAPH NO V
STACK LOSS CHART FOR METHANE, ETHANE, PROPANE, BUTANE AND THEIR MIXTURES


GRAPH NO VI
STACK LOSS CHART FOR
10 A.P.I. PETROLEUM OIL
B.T.U./LB. = 18540
C = 89%
H = 11%
PER CENT EXCESS AIR


GRAPH NO VII
STACK LOSS CHART FOR
REFINERY GAS
B.T.U./ft.3 = 22,500
C = 81%
H2 = 19%
DATUM LINE 60°F
PER CENT EXCESS AIR


GRAPH NO VIII
STACK LOSS CHART FOR
40 A.P.I. PETROLEUM OIL
B.T.U./lb. = 19,750
C = 86.38
H2 = 13.62
DATUM LINE 60°F
PER CENT EXCESS AIR

usually consist of more than one atom. Molecules of elementary gases such as oxygen, nitrogen, and hydrogen consist of two atoms. Elements are designated by symbols and compounds by combination of the symbols of their constituent elements. The chemical reaction between elements or compounds is the rearrangement of the atoms of the constituent elements into a new combination of molecules.

All combustion calculations are based on a relatively few simple laws and their application to combustion problems. The four simple laws on which all combustion calculations depend are as follows:

(1) Conservation of matter — matter cannot be created or destroyed.
(2) Conservation of energy — energy cannot be created or destroyed.
(3) The gas law—the volume of a gas is directly proportional to its absolute temperature, and inversely proportional to its absolute pressure.
(4) The law of combining weights—all substances combine only in accordance with a definite simple relationship as to relative weights.

Chemical reactions always occur in accordance with fixed and invariable weight relations which are characteristic of the elements involved. The number of chemical reactions relating to combustion are relatively few and those primarily encountered are as follows:

(1) $C + O_2 = CO_2$
(2) $2C + O_2 = 2CO$
(3) $2CO + O_2 = 2CO_2$
(4) $2H_2 + O_2 = 2H_2O$
(5) $S + O_2 = SO_2$
(6) $CH_4 + 2O_2 = CO_2 + 2H_2O$
(7) $2C_2H_6 + 7O_2 = 4CO_2 + 6H_2O$
(8) $C_3H_8 + 5O_2 = 3CO_2 + 4H_2O$
(9) $2C_4H_{10} + 13O_2 = 8CO_2 + 10H_2O$

To simplify combustion calculations the pound mol system is used. To calculate combustion by the pound mol system it is essential to have a clear understanding of the pound mol. A pound mol of any substance is its molecular weight in pounds. A pound mol of any substance whether solid, liquid, or gaseous is therefore a quantity, the weight of which in pounds is expressed by the same number as its molecular weight. The molecular weight of carbon dioxide is 44. A pound mol of carbon dioxide therefore consists of 44 pounds of carbon dioxide. The molecular weight of carbon is 12 and a pound mol of carbon consists of 12 pounds of carbon. For combustion calculations it is essential to know that a pound mol of any substance in the gaseous state occupies under standard conditions (760 mm. pressure and 32° F.) 359 cubic feet and at 60° F. and 760 mm. pressure occupies 379.4 cubic feet. Calculations in this paper will be based on oxygen for combustion being derived from the air. The air consists of 30.91 per cent of oxygen and 79.09 per cent of nitrogen by volume. For each cubic foot or mol of oxygen required for combustion there accompanies it 3.7824 cubic feet or 3.7824 mols of nitrogen.

The common combustion reactions written to include nitrogen (which does not react and is an inert gas) are as follows:

(1) $C + O_2 + 3.7824N_2 = CO_2 + 3.7824N_2$
(2) $2C + O_2 + 3.7824N_2 = 2CO_2 + 3.7824N_2$
(3) $2CO + O_2 + 3.7824N_2 = 2CO_2 + 3.7824N_2$
(4) $2H_2 + O_2 + 3.7824N_2 = 2H_2O + 3.7824N_2$
(5) $S + O_2 + 3.7824N_2 = SO_2 + 3.7824N_2$
(6) $CH_4 + 2O_2 + 7.5648N_2 = CO_2 + 2H_2O + 7.5648N_2$
(7) $2C_2H_6 + 7O_2 + 26.4768N_2 = 4CO_2 + 6H_2O + 26.4768N_2$
(8) $C_3H_8 + 5O_2 + 18.9120N_2 = 3CO_2 + 4H_2O + 18.9120N_2$
(9) $2C_4H_{10} + 13O_2 + 49.1712N_2 = 8CO_2 + 10H_2O + 49.1712N_2$

The first seven of the above equations are the ones most commonly used. Equation No. 1 shows that one mol (12 pounds) of carbon requires one mol (32 pounds) of oxygen to produce one mol (44 pounds) of CO_2. The nitrogen accompanying the oxygen appears on both sides of the equation and does not enter into the chemical reaction.

Heats of Reaction

When substances react heat is always given off or absorbed. The heat evolved or absorbed is usually expressed in British thermal units (B.t.u.). The B.t.u. will be used as the unit of heat and is the amount of heat required to raise 1 pound of pure water from 59° F. to 60° F. and for all practical purposes can be assumed to be the amount of heat required to raise one pound of water one degree Fahrenheit. The molal heats of reaction of the more important chemical reactions relating to combustion problems are as follows:

(1) $C + O_2 = CO_2 + 174{,}528$ B.t.u.
(2) $2C + O_2 = 2CO + 104{,}256$ B.t.u.
(3) $2CO + O_2 = 2CO_2 + 244{,}838$ B.t.u.
(4) $2H_2 + O_2 = 2H_2O + 246{,}274$ B.t.u.
(5) $CH_4 + O_2 = CO_2 + 2H_2O + 383{,}771$ B.t.u.
(6) $2C_2H_6 + 7O_2 = 4CO_2 + 1{,}336{,}916$ B.t.u.
(7) $C_3H_8 + 5O_2 = 3CO_2 + 4H_2O + 952{,}068$ B.t.u.
(8) $2C_4H_{10} + 13O_2 = 8CO_2 + 10H_2O + 2{,}473{,}510$ B.t.u.
(9) $S + O_2 = SO_2 + 259{,}000$ B.t.u.
(10) $C + CO_2 = 2CO - 70{,}372$ B.t.u.
(11) $C + H_2O = CO + 2H_2 - 71{,}600$ B.t.u.
(12) $CO + H_2O = CO_2 + H_2 - 700$ B.t.u.

The above equations showing heat evolved or absorbed are based on a pound mol of reacting substance. Equation No. 1 shows that one pound mol of carbon (12 pounds) when burned to carbon dioxide liberates 174,528 B.t.u. Equation No. 2 shows that two pound mols (24 pounds) of carbon when burned to carbon monoxide liberates 104,256 B.t.u. Equations No. 10, 11 and 12 show that heat is required to cause the reaction.

Specific Heats and Heat Capacities of Gases

The specific heat of a gas is a ratio of the heat required to raise a pound of gas one degree Fahrenheit to the heat required to raise a pound of water one degree Fahrenheit. Since specific heat represents merely a ratio, the specific heat expressed in calories per gram or molal specific heat expressed in calories per gram mol is the same as the specific heat expressed in B.t.u. per pound or the molal specific heat expressed in B.t.u. per pound mol. The heat required to raise any substance from one temperature to a different temperature is the product of the weight of the substance, the temperature increment, and the mean specific heat of that substance per unit weight over the temperature range in question. Molal specific heat may be defined as the ratio of the heat required to raise one pound of any substance one degree Fahrenheit to the quantity of heat required to raise one pound of water one degree Fahrenheit. Much has been written on the subject of specific heats of gases and the latest information available appears in Technical Paper No. 445 of the U. S. Department of Commerce and these values have been used in compiling this paper. The general form of the equation for instantaneous specific heat at a temperature "T" is as follows:

$$MCp = a + bT + cT^2 + dT^3$$

Where:

MCp = instantaneous molal specific heat.
a, b, c, and d = constants.
T = temperature.

The mean specific heat between temperatures T_1 and T_2 may be determined from the following formulae:

$$MCp = \int_{T_1}^{T_2} \left(\frac{a + bT + cT^2 + dT^3}{T_2 - T_1} \right) dT$$

or by integration the mean specific heat of a gas may be calculated as follows:

$$MCp = a + b/2(T_2+T_1) + c/3[(T_2-T_1)^2 - T_2T_1] + d/4(T_2+T_1)[(T_2+T_1)^2 - 2T_2T_1]$$

The constants for calculation of molal heat capacities of gases as given by the Department of Commerce Bulletin No. 445 are shown in Table 1.

Converting the above data to degrees Rankine (°F. + 460) and integrating, the following revised formulae for calculation of the mean molal specific heats (MCp) over any temperature range of the products of combustion may be used:

$$MCp\ SO_2,\ CO_2 = 7.7 + .001472(T_1+T_2) - .00000008539[(T_1+T_2)^2 - T_1T_2]$$

$$MCp\ O_2,\ H_2,\ Air = 6.76 + .0001683(T_1+T_2) + .00000001337[(T_1+T_2)^2 - T_1T_2]$$

$$MCp\ H_2O = 8.22 + .00004165(T_2-T_1) + .0000001379[(T_1-T_2) - T_1T_2]$$

Where T_1 and T_2, the two temperatures in question, are expressed in degrees Rankine (°F. absolute).

To obtain the mean specific heat per pound of the above gases divide the molal specific heat by the molecular weight. To obtain the total heat per pound mol of the bases common in combustion work between any temperature range the following formulae may be used:

$$CO_2,\ SO_2 = (T_2-T_1)\{7.7 + .001472(T_1+T_2) - .00000008539[(T_1+T_2)^2 - T_1T_2]\}$$

$$O_2,\ N_2,\ CO,\ Air = (T_2-T_1)\{6.76 + .0001683(T_1+T_2) + .00000001337[(T_1+T_2)^2 - T_1T_2]\}$$

$$H_2O = (T_2-T_1)\{8.22 + .00004165(T_1+T_2) - .0000001379[(T_1+T_2)^2 - T_1T_2]\}$$

Where T_1 and T_2 are expressed in degrees Rankine (°F. absolute).

From the above equations the total heat content of the gases commonly encountered in combustion problems were calculated for each 100° F. above 0° F. and the calculated values may be found in Technical Paper No. 445 of the U. S. Department of Commerce. Interpolations may be made between the calculated values which are sufficiently accurate for everyday use. In addition the mean molal specific heats are given, the heat content per pound of gas, and the mean specific heat per pound of gas. To determine the heat content per pound of gas divide the heat per pound mol by the molecular weight. To determine the mean specific heat per pound of gas divide the total heat content per pound between the two temperature limits by the temperature range in question. It can be readily seen that combustion calculations on a pound mol basis is simplified as the molal and mean specific heat capacities of some of the gases are identical.

Molal Combustion Calculations

To simplify the understanding of the pound mol method it seems advisable to include a few general formulae as follows:

(1) C/12 = Pound mols of carbon burned—pound mols of oxygen required to burn the carbon—and the pound mols of carbon dioxide produced.
(2) H/4 = Pound mols of oxygen required to burn the hydrogen in the fuel.
(3) H/2 = Pound mols of water vapor formed.
(4) O/32 = Pound mols of oxygen in the fuel.
(5) N/28 = Pound mols of nitrogen supplied by nitrogen in the fuel.

TABLE NO. 1

Gases—	a	b10⁻³	c10⁻⁶	Temp. limits °Kelvin*	Estimated limit of average error
CO_2, SO_2	7.70	5.30	—.83	300-2,500	2.5%
N_2, O_2, CO, Air	6.76	.606	.13	300-2,500	1.5%
H_2O	8.22	.15	1.34	300-2,500	1.5%

*Kelvin = °C. absolute (°C. + 273).

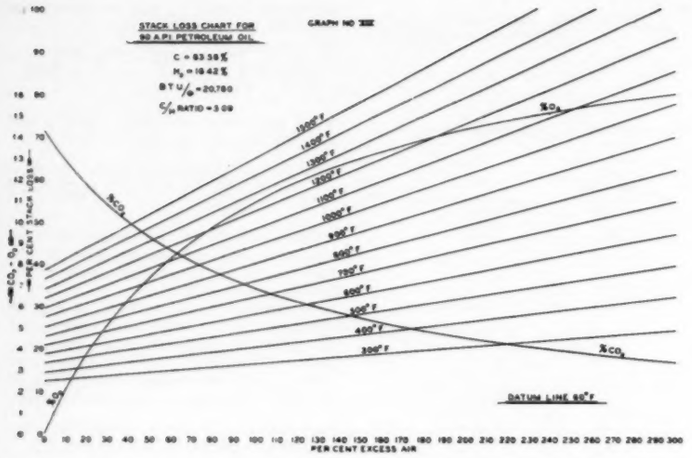
TABLE 2—MOLAL CONSTANTS AND CHEMICAL EQUATIONS

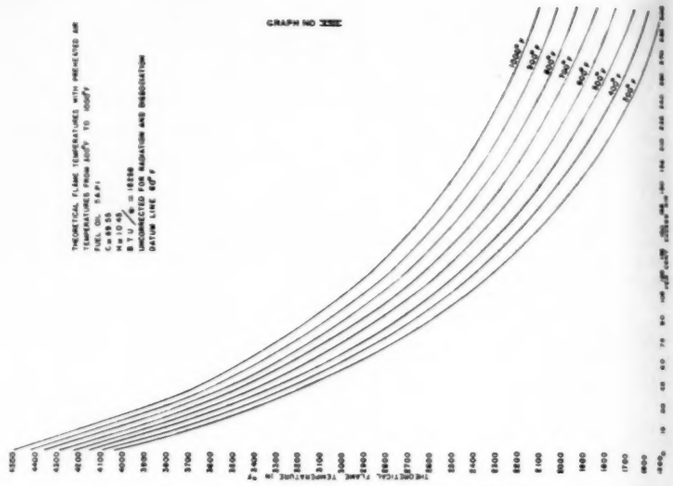
	Mols per mol: Required for complete combustion: Oxygen	Air	Products of combustion: CO_2	H_2O	N_2	Per cent theoretical CO_2 (dry gas basis)	Chemical equations
Carbon	1.0	4.7824	1	..	3.7824	20.9100	$2C+2O_2=2CO_2$
Hydrogen	.5	2.3912	..	1	1.8912	.....	$2H_2+O_2=2H_2O$
Carbon monoxide	.5	2.3912	1	..	1.8912	34.7222	$2CO+O_2=2CO_2$
Carbon dioxide	...	.....	..	..	.....	.....	
Oxygen	...	.....	..	..	†3.7824	.....	
Nitrogen	...	.....	..	..	‡ .2644	.....	
Sulphur	1.0	4.7824	*2	..	7.5648	.....	$S+O_2=SO_2$
Hydrogen sulphide	1.5	7.1736	*1	1	5.6736	.....	$2H_2S+3O_2=2H_2O+2SO_2$
Water	...	.....	..	..	.....	.....	
Benzol	7.5	35.8680	6	3	28.3680	17.4582	$2C_6H_6+15O_2=12CO_2+6H_2O$
Toluol	9.0	43.0416	7	4	34.0416	17.0558	$C_7H_8+9O_2=7CO_2+4H_2O$
Xylene	10.5	50.2152	8	5	39.7152	16.7661	$C_8H_{10}+21O_2=16CO_2+10H_2O$
Naphthalene	12.0	.....	10	4	45.3888	18.0541	$C_{10}H_8+12O_2=10CO_2+4H_2O$
Methane	2.0	9.5648	1	2	7.5648	11.6757	$CH_4+2O_2=CO_2+2H_2O$
Ethane	3.5	16.7384	2	3	13.1247	13.1839	$2C_2H_6+7O_2=4CO_2+6H_2O$
Propane	5.0	23.9120	3	4	18.9120	13.6911	$C_3H_8+5O_2=3CO_2+4H_2O$
Butane	6.5	31.0856	4	5	24.5856	13.9934	$2C_4H_{10}+13O_2=8CO_2+10H_2O$
Ethylene	3.0	14.3472	2	2	11.3472	14.9844	$C_2H_4+3O_2=2CO_2+2H_2O$
Propylene	4.5	21.5208	3	3	17.0208	14.9844	$2C_3H_6+9O_2=6CO_2+6H_2O$
Butylene	6.0	28.6944	4	4	22.6944	14.9844	$C_4H_8+6O_2=4CO_2+4H_2O$
Acetylene	2.5	11.9560	2	1	9.4560	17.4581	$2C_2H_2+5O_2=4CO_2+2H_2O$
Air	...	.....	..	..	.....	.....	
Sulphur dioxide	...	.....	..	..	.....	.....	
Carbon to monoxide	.5	2.3914	..	..	1.8912	.....	$2C+O_2=2CO$

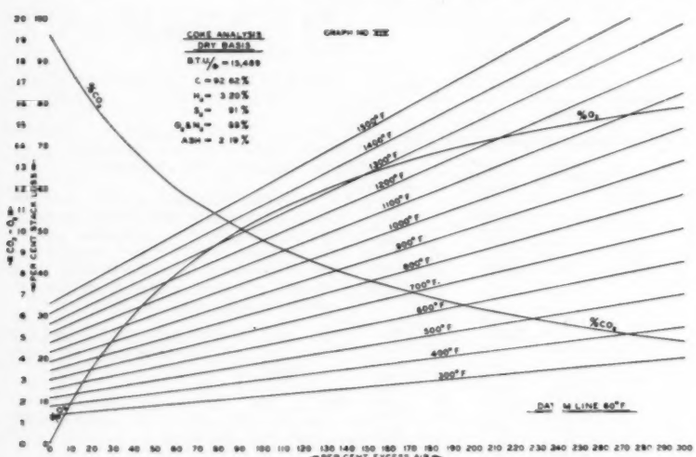
*SO_2 †Since O_2 is supplied by the air each mol of oxygen is accompanied by 3.7824 mols of nitrogen. ‡When air is used for combustion the oxygen supplied by the air equals .2644 nitrogen.

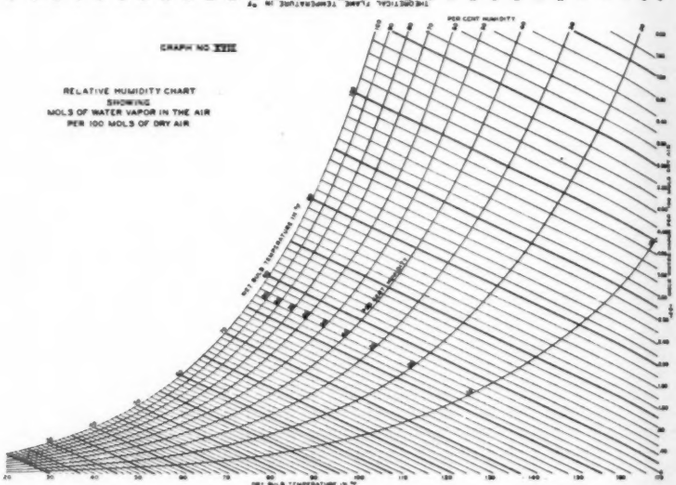
TABLE 3—ELEMENTARY CONSTANTS RELATING TO COMBUSTION CALCULATIONS

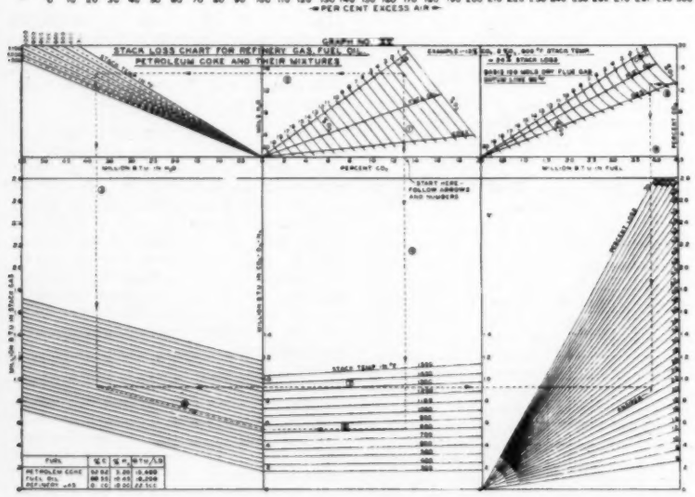
	Molec. symbol	Molec. wt. Approx.	Molec. wt. Accur.	Atomic wt. Approx.	Atomic wt. Accur.	Specific gravity (Air=1)	Wt. per cu. ft. (dry)	Relative densities	Form
Carbon	C	12	.....	12	12.005	.....	.....	..	Solid
Hydrogen	H_2	2	2.016	1	1.008	.0695	.00531	1	Gas
Carbon monoxide	CO	28	28.01	..	.....	.9665	.07381	14	Gas
Carbon dioxide	CO_2	44	44.01	..	.....	1.5188	.11598	22	Gas
Oxygen	O_2	32	32.00	16	16.000	1.1046	.08435	16	Gas
Nitrogen	N_2	28	28.02	14	14.01	.9671	.07385	14	Gas
Sulphur	S_2	64	64.14	32	32.07	.....	.....	..	Solid
Hydrogen sulphide	H_2S	34	34.08	..	.....	1.1767	.08986	..	Gas
Water	H_2O	18	18.02	..	.....	.....	.....	..	
Benzol	C_6H_6	78	78	..	.....	2.6940	.20570	39	Gas
Toluol	C_7H_8	92	92.10	..	.....	3.1778	.24270	46	Gas
Xylene	C_8H_{10}	106	106.1	..	.....	3.6616	.27962	53	Gas
Naphthalene	$C_{10}H_8$	128	128.1	..	.....	.....	.....	..	Solid
Methane	CH_4	16	16	..	.....	.5534	.04226	8	Gas
Ethane	C_2H_6	30	30	..	.....	1.0371	.07920	15	Gas
Propane	C_3H_8	44	44.1	..	.....	1.5210	.11615	22	Gas
Butane	C_4H_{10}	58	58.1	..	.....	2.0047	.15309	29	Gas
Ethylene	C_2H_4	28	28	..	.....	.9676	.07389	14	Gas
Propylene	C_3H_6	42	42	..	.....	1.4513	.11083	21	Gas
Butylene	C_4H_8	56	56.1	..	.....	1.9352	.14778	28	Gas
Acetylene	C_2H_2	26	26	..	.....	.8981	.06858	13	Gas
Air	....	29	28.94	..	.....	.....	.08071	14	Gas
Sulphur dioxide	SO_2	64	64.07	..	.....	2.2639	.1872	32	Gas
Carbon to monoxide	....	..	.....	..	.....	.....	.....	..	Gas

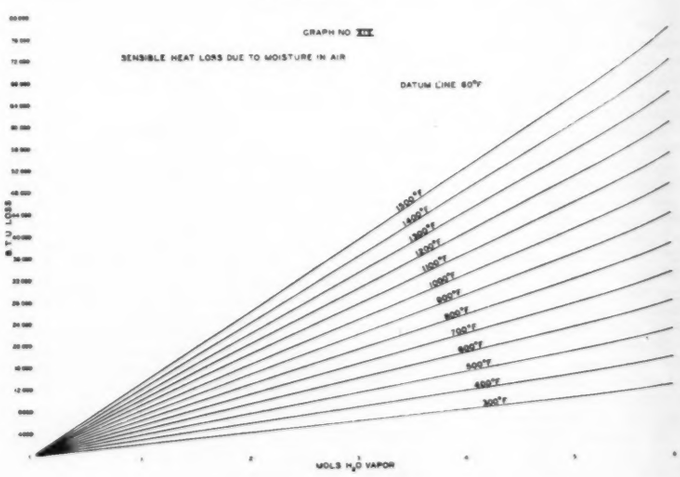


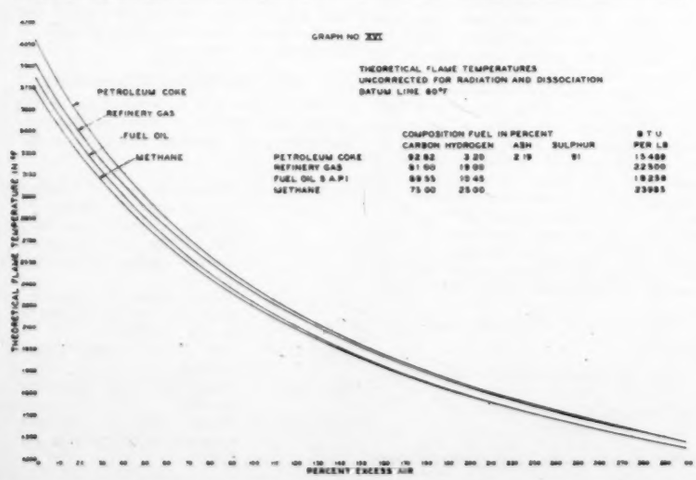





GRAPH NO XVIII
RELATIVE HUMIDITY CHART
SHOWING
MOLS OF WATER VAPOR IN THE AIR
PER 100 MOLS OF DRY AIR
PER CENT HUMIDITY
WET BULB TEMPERATURE IN °F
DRY BULB TEMPERATURE IN °F

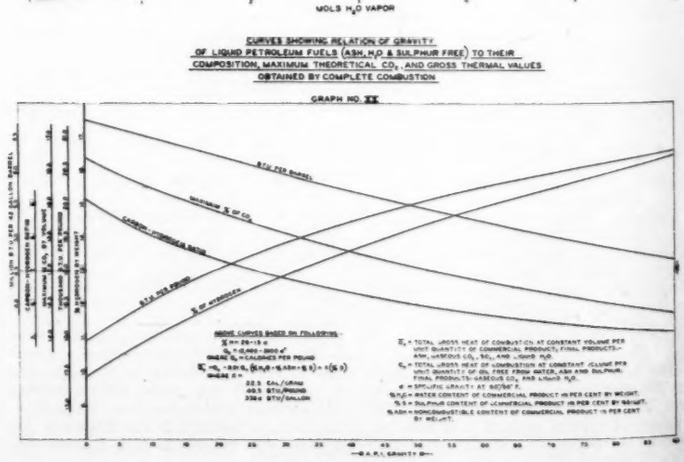

GRAPH NO XV
STACK LOSS CHART FOR REFINERY GAS, FUEL OIL, PETROLEUM COKE AND THEIR MIXTURES
START HERE - FOLLOW ARROWS AND NUMBERS
STACK TEMP. IN °F
PERCENT CO2
MILLION B.T.U. IN FUEL
MILLION B.T.U. IN STACK GAS
FUEL
PETROLEUM COKE
FUEL OIL
REFINERY GAS





	COMPOSITION FUEL IN PERCENT CARBON	HYDROGEN	ASH	SULPHUR	B T U PER LB
PETROLEUM CORE	92 62	3 20	2 19	91	15 488
REFINERY GAS	81 00	19 00			22 500
FUEL OIL 9 A P I	89 55	10 45			18 250
METHANE	75 00	25 00			23985

CURVES SHOWING RELATION OF GRAVITY OF LIQUID PETROLEUM FUELS (ASH, H2O & SULPHUR FREE) TO THEIR COMPOSITION, MAXIMUM THEORETICAL CO2 AND GROSS THERMAL VALUES OBTAINED BY COMPLETE COMBUSTION



(6) $S/32$ = Pound mols of sulphur burned and also the pound mols of SO_2 produced, and the pound mols of oxygen to burn the sulphur in the fuel.

Where the symbols C, H, O, N, and S represent the number of pounds of carbon, hydrogen, oxygen, nitrogen, and sulphur in a unit weight of fuel (usually taken as 100 pounds for convenience).

The theoretical per cent CO_2 when burning any fuel may be calculated from the following general equation:

$$(7)\quad \left[\frac{C/12}{C/12+N/28+3.7824(C/12+H/4-O/32+S/32)}\right]\times 100 = \%\text{ theoretical } CO_2$$

Where the symbols C, H, O, N, and S represent the number of pounds of carbon, hydrogen, oxygen, nitrogen, and sulphur in a unit weight of fuel.

Simplifying the above equation it may be written as follows:

$$(8)\quad \text{Theoretical }\%\ CO_2 = \frac{100C}{C+3N/7+.4278(8C+24H-3O+3S)}$$

Assuming a petroleum product contains only carbon and hydrogen the simplified equation becomes:

$$(9)\quad \text{Theoretical }\%\ CO_2 = \frac{100C}{4.7824C+11.3472H}$$

Most heavy fuels contain some sulphur, which when burned produces SO_2, which shows up as CO_2 in an orsat analysis. The simplified equation for thetoretical CO_2 and SO_2 when burning a fuel containing carbon, hydrogen, and sulphur and no oxygen or nitrogen is as follows:

$$(10)\quad \text{Theoretical }\%\ CO_2 + SO_2 = \frac{8C+3S}{3.2592C+3.7824(24H+3S)}\times 100$$

The theoretical per cent of nitrogen in the dry flue gas may be determined by the following equations:

(11) 100 — % theoretical CO_2 = % N_2 for sulphur, oxygen and nitrogen free fuels.

(12) 100 — (% theoretical CO_2 + % theoretical SO_2) = % theoretical N_2 for oxygen and nitrogen free fuels.

The mols of water vapor produced by the burning of hydrogen in the fuel per 100 mols of dry gas may be calculated in one of two ways, either of which is correct. The equations for calculating mols of water vapor per 100 mols of dry fuel gas are as follows:

$$(13)\quad \frac{\%\ CO_2\times 1{,}200\times \%\ H_2\text{ in fuel}}{\%\text{ C in fuel}\times 2} =$$

mols H_2O per 100 mols dry flue gas,

or

(14) $2(.2643\ \%\ N_2 - \%\ CO_2 + \%\ O_2)$ = mols H_2O per 100 mols dry flue gas.

Equations No. 13 and No. 14 are based on fuel containing no oxygen or nitrogen.

Heat released per 100 mols of dry flue gas may be calculated from the following equation:

$$(15)\quad \frac{\%\ CO_2\text{ in dry flue gas}\times 1{,}200}{\%\text{ C in fuel}}\times$$

B.t.u. per pound of fuel = B.t.u. released per 100 mols dry flue gas.

Example of Molal Combustion Calculation

With a clear understanding of the pound mol system of combustion calculations as related to combustion problems calculations are simplified as illustrated by the following example:

It is desired to know the per cent stack loss when burning 5° A.P.I. fuel oil (ash, water, and sulphur free) with an average per cent CO_2 of 13.517, an average per cent O_2 of 3.65, an average stack temperature of 300° F., an ultimate analysis of the fuel shows per cent C to be 89.55, per cent H_2 to be 10.45, and a gross heating value of 18,258 B.t.u. per pound, and outside air temperature being 60° F.

$$(1)\quad \frac{13.517\times 1{,}200}{89.55}\times 18{,}258 = 3{,}307{,}113$$

B.t.u. burned per 100 mols dry flue gas.

(2) The mols of water vapor formed per 100 mols of dry flue gas is calculated as follows:

$$\frac{\%\ CO_2\times 1.200\times \%\ H_2\text{ in fuel}}{\%\text{ C in fuel}\times 2} =$$

mols H_2O per 100 mols dry flue gas.

$$\frac{13.517\times 1{,}200\times 10.45}{89.55\times 2} = 9.4642.$$

(3) Sensible heat loss per 100 mols of dry products of combustion is calculated as follows:

Heat loss in CO_2 = Mols CO_2 × (Heat content at 300° F. — Heat content at 60° F.)

Heat loss in $O_2 + N_2$ = Mols $O_2 + N_2$ × (Heat content at 300° F. — Heat content at 60° F.)

	B.t.u.
Heat loss in CO_2 = 13.517(*2,819.66 — *544.87)	= 29,396.64
Heat loss in $O_2 + N_2$ = 86.483 (*2,094.1 — *416.08)	= 145,120.20
Total dry gas loss	= 174,516.84

*See gas tables.

(4) Heat loss due to formation of water vapor by the burning of hydrogen is calculated as follows:

Heat loss = Mols H_2O × 18[(212 —60) + 970.2] + Sensible heat per mol from 212° to T.

= 9.4742 × 18[(212 — 60) + 970.2] + (*2,528.36 — *1,781.06)

= 198,245.65

(5) The total heat loss per 100 mols of dry flue gas is tabulated as follows:

	B.t.u.
Heat loss in CO_2	= 29,396.64
Heat loss in $O_2 + N_2$	= 145,120.20
Heat loss in H_2O	= 198,245.65
Total heat loss	= 372,762.49

(6) Per cent stack loss equals the stack loss per 100 mols of dry flue gas divided by the B.t.u. required to produce 100 mols of dry flue gas as follows:

$$\frac{\text{B.t.u. loss}}{\text{B.t.u. input}}\times 100 = \%\text{ stack loss}$$

$$\frac{372{,}762.49}{3{,}307{,}113.00}\times 100 = 11.27\%$$

To check the above calculations refer to the stack loss chart for 5° A.P.I. fuel oil.

The enclosed tables and graphs were compiled for complete combustion with dry air. The per cent humidity varies over such wide ranges for different parts of the country and is usually a small loss that it was not included in the stack loss charts. For practical purposes losses due to moisture in the air may be neglected. For those interested in losses due to humidity the following formula may be used:

$$(16)\quad \text{Per cent Humidity loss} = \frac{\%N_2\text{ in flue gas}\times\text{mols }H_2O/100\ \dagger\text{mols dry air}\times\ddagger\text{sensible heat/mol }H_2O\times\%C\text{ in fuel}}{949.08\times\%\ CO_2\text{ in flue gas}\times\text{B.t.u. per pound of fuel}}$$

†Refer to Graph 17. ‡Refer to Graph 18.

Example: Determine humidity loss when burning 5° A.P.I. fuel oil with a stack temperature of 1,000° F., outside air 60° F., relative humidity 50 per cent. B.t.u. per pound of fuel 18.258 — per cent C in fuel of 89.55 — flue gas analysis shows 12 per cent CO_2, 5.6 per cent O_2, and 82.4 per cent N_2.

Inserting the numerical values in Equation No. 16 the per cent loss due to moisture in the air becomes:

$$\%\text{ Humidity loss} = \frac{82.4\times.83\dagger\times 7{,}200\ddagger\times 89.55}{949.08\times 12\times 18{,}298} = .21\%$$

If a fuel contains moisture the per cent loss due to this moisture may be calculated as follows:

$$\frac{\text{B.t.u. per pound of fuel}}{\text{Moisture per pound of fuel}\times(\text{sensible}+\text{latent heat between 60° F.—T})}\times 100 = \%\text{ loss}$$

Calculation of Theoretical Flame Temperatures

The calculation of theoretical flame temperatures is a cut and try proposition. The heat released and the products of combustion are first calculated per 100 mols of dry flue gas. A temperature is assumed and the heat input to the products of combustion is calculated for the assumed temperature. If the total heat in the products of combustion equals the heat in the fuel the assumed temperature is correct. If the heat input to the products of combustion is less than the heat in the fuel the temperature is too low and a higher temperature must be assumed and the calculations repeated. Conversely if the temperature is too high a lower temperature must assumed. When calculating a theoretical flame temperature with preheated air the heat in the air may be assumed as heat in the fuel and calculations made from atmospheric temperature. Graph 20 shows the effect of preheated air for combustion on the flame temperature when burning 5° A.P.I. fuel oil. The increase in flame temperature is not directly proportional to the increase in air temperature due to the increase in the specific heat of the products of combustion at elevated temperatures.

Summary

The accompanying tables and graphs were compiled for complete combustion of representative petroleum fuels commonly encountered in the oil industry. No consideration was given to the stack loss by the formation of carbon monoxide as it is the writer's opinion that if carbon monoxide is produced by improper burner or furnace design that the burner or furnace should be changed to eliminate carbon monoxide. Also, no reference was made to losses due to unburned carbon. If unburned carbon exists when burning petroleum coke the burner or furnace should be changed to eliminate any unburned carbon to the extent that any unburned carbon loss would be negligible.

There should be no excuse for the formation of carbon monoxide or unburned fuel if the burner and furnace are properly designed. In the burning of any fuel if the proper Time, Temperature and Turbulence are maintained no carbon monoxide or appreciable quantities of unburned fuel will result. Burner design is very important in most oil refinery furnaces and the burner should also be of such design to prevent flame impingement on tubes of cracking still furnaces and to obtain proper distribution of heat with a minimum quantity of excess air.

Acknowledgment is made to Messrs. Herbert Sloan and C. A. Underwood of the Sinclair Refining Co. in assisting the compiling of this data during the past few years.

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TABLE 4—ELEMENTARY CONSTANTS RELATING TO COMBUSTION CALCULATIONS

	Theoretical flame temp.	B.t.u. per cubic foot: High 60° F. 30" sat. H_2O	High 60° F. 30" dry	Low 60° F. 30" sat. H_2O	Low 60° F. 30" dry	High 32° F. 30"	Low 32° F. 30"	B.t.u. per mol: High	Low	Ignition temp., deg. F.	B.t.u. per lb.: High	Low
Carbon	....	....	....	....	....	....	....	.....	.....	....	.....	.....
Hydrogen	4,010	318.8	324.5	269.1	274.5	343	290	123,137	104,110	1,130	61,568	52,055
Carbon monoxide	4,475	317.1	322.6	317.1	322.6	341	341	122,419	122,419	1,210	4,372	4,372
Carbon dioxide	....	....	....	....	....	....	....	.....	.....	....	.....	.....
Oxygen	....	....	....	....	....	....	....	.....	.....	....	.....	.....
Nitrogen	....	....	....	....	....	....	....	.....	.....	....	.....	.....
Sulphur	....	....	....	....	....	....	....	.....	.....	470	.....	.....
Hydrogen sulphide	....	....	....	....	....	....	....	.....	.....	....	.....	.....
Water	....	....	....	....	....	....	....	.....	.....	....	.....	.....
Benzol	4,110	3,658	3,722	3,509	3,577	3,933	3,774	1,411,947	1,354,866	....	18,101	17,370
Toluol	4,050	4,364	4,441	4,165	4,241	4,693	4,481	1,684,787	1,608,679	....	18,312	17,485
Xylene	4,010	5,064	5,153	4,815	4,902	5,446	5,181	1,955,114	1,859,979	....	18,444	17,547
Naphthalene	4,100	....	....	....	....	....	....	2,219,000	2,143,000	....	17,325	16,742
Methane	3,750	995	1,012	896	913	1,069	963	383,771	345,717	1,202	23,985	21,607
Ethane	3,820	1,731	1,762	1,582	1,612	1,862	1,703	668,458	611,377	1,000	22,282	20,379
Propane	3,840	2,485	2,509	2,266	2,309	2,652	2,440	952,068	875,960	....	21,637	19,908
Butane	3,870	3,204	3,261	2,955	3,010	3,445	3,180	1,236,755	1,141,620	....	21,323	19,683
Ethylene	4,250	1,613	1,641	1,514	1,541	1,734	1,631	622,506	585,529	1,022	22,232	20,911
Propylene	4,090	2,313	2,354	2,164	2,204	2,487	2,328	892,833	835,752	....	21,257	19,898
Butylene	4,030	3,033	3,087	2,834	2,887	3,262	3,050	1,171,058	1,094,950	....	20,911	19,553
Acetylene	4,770	1,456	1,483	1,396	1,433	1,567	1,514	562,553	543,526	900	21,636	20,905
Air	....	....	....	....	....	....	....	.....	.....	....	.....	.....
Sulphur dioxide	....	....	....	....	....	....	....	.....	.....	....	.....	.....
Carbon to monoxide	....	....	....	....	....	....	....	.....	.....	....	.....	.....

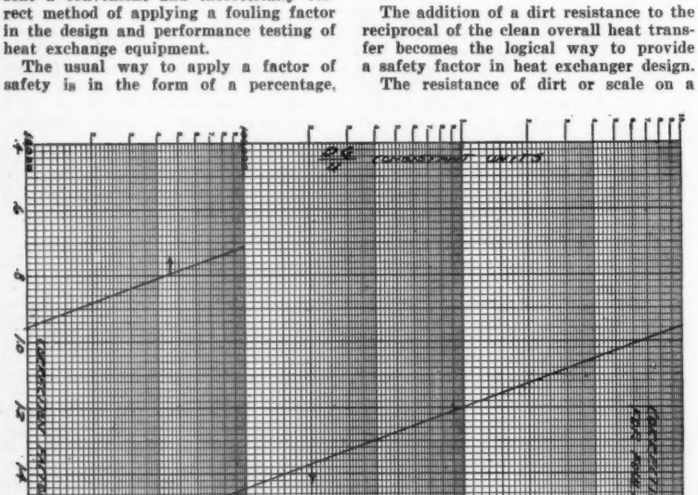
Application of Fouling Factors in the Design of Heat Exchangers; Simple Method Given

By E. N. SIEDER
Foster Wheeler Corp., New York*

Designers and users of heat transfer equipment will appreciate the fact that the full effectiveness of such equipment can only be realized with the transfer surface in a clean condition. When a set performance must be maintained over a reasonable period, additional surface must be provided over that theoretically required. The amount of extra surface required has always been a matter of judgment or experience on the part of the designer or user.

It is the purpose of this paper to present a convenient and theoretically correct method of applying a fouling factor in the design and performance testing of heat exchange equipment.

The usual way to apply a factor of safety is in the form of a percentage,



Curve 1

where the extra surface is expressed as a percentage of the theoretical or clean surface requirements. This method is faulty as it does not give a true picture of the allowance made for dirt.

Resistance Theory

Let us go back to the basic resistance theory of heat transfer where the total resistance to the flow of heat from one fluid to another is considered to be the sum of several resistances. If we let R represent the total resistance to heat flow, r_{f_1} the film resistance of one fluid, r_{d_1} the resistance due to dirt on one side of the tube, r_t the tube wall resistance, r_{d_2} the resistance due to dirt on the other side of the tube and r_{f_2} the film resistance of the second fluid. Then

$$R = r_{f_1} + r_{d_1} + r_t + r_{d_2} + r_{f_2} \qquad (1)$$

Most of us think in terms of film coefficients instead of film resistance so we can convert the film resistances into conductances or transfer coefficients, where U and h represent overall and film transfer coefficients respectively.

$$\frac{1}{U_d} = \frac{1}{h_1} + \frac{1}{h_2} + r_t + r_{d_1} + r_{d_2} \qquad (2)$$

For most problems we can neglect r_t and combine the two dirt resistances into a common dirt resistance r_d. Therefore

$$\frac{1}{U_d} = \frac{1}{h_1} + \frac{1}{h_2} + r_d \qquad (3)$$

but

$$\frac{1}{U_c} = \frac{1}{h_1} + \frac{1}{h_2} \qquad (4)$$

so

$$\frac{1}{U_d} = \frac{1}{U_c} + r_d \qquad (5)$$

The addition of a dirt resistance to the reciprocal of the clean overall heat transfer becomes the logical way to provide a safety factor in heat exchanger design.

The resistance of dirt or scale on a plain surface can be represented by the relation

$$r = \frac{t}{k} \qquad (6)$$

where t is the thickness of the layer and k is the conductivity. This relation could be considered approximately true for dirt layers on tubes where the thickness t is not great.

Values of dirt resistances usually lie in the range .001 to .01. If we should multiply r_d by 1,000 the resultant would usually be larger than unity and could be called a fouling factor. If we let D equal this fouling factor, then

$$D = r_d \times 1{,}000 \qquad (7)$$

Thus we have a convenient unit ranging from about 1 to 10 for expressing the amount of fouling.

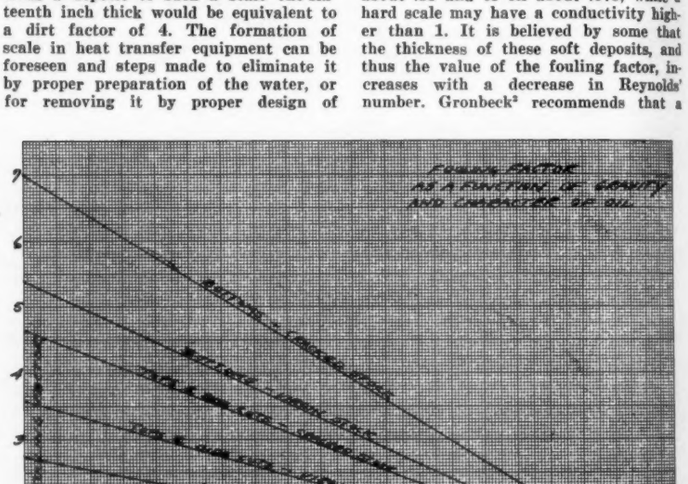
It is readily seen that a given dirt resistance affects the operation of equipment designed for higher transfer rates more than if it were designed for low transfer rates. It is for this reason that we are not correct in using a percentage basis for applying a factor of safety.

Types and Varieties

There are any number of types and varieties of fouling. It would be a gigantic task to study the effect of more than a few common types. We might divide types of fouling into three main classifications:

1. The hard deposits such as scale, rust, etc.
2. Soft films of mud, carbon or similar material.
3. Loose deposits of silt, soot or dry coke.

Probably the most familiar form of dirt is the hard scale that forms on tubes through which water flows. Designers and operators of boilers, feed water heaters, evaporators, etc., are well acquainted with such scales. The order of resistance due to scale is not high but the equipment in which it occurs is usually designed for high overall transfer rates so that the effect of the scale is very pronounced. Partridge[1] recommends the use of a conductivity for boiler scale of 1.3 B.t.u. per foot degree Fahrenheit hour. Thus a deposit of such a scale one-sixteenth inch thick would be equivalent to a dirt factor of 4. The formation of scale in heat transfer equipment can be foreseen and steps made to eliminate it by proper preparation of the water, or for removing it by proper design of equipment. The formation of other hard foreign substances, such as rust, products of corrosion, etc., can be eliminated by the use of proper materials for heat transfer surfaces.



Curve 2

The class of dirt most bothersome to oil refiners and operators of industrial plants is that caused by dirty water or by suspended matter in the products. The nature and extent of such dirt cannot always be anticipated as it will vary considerably depending upon local conditions, design of equipment and operation. Here perhaps the most common form of fouling is the slime or mud deposited on the inside of tubes from dirty water used as a cooling medium. Here again control of local conditions will help considerably in preventing undue deposits. Proper design of heat exchange equipment to provide high velocities, installation of strainers, settling tanks, etc., should be resorted to.

Collection of Debris

A very annoying form of fouling may be caused by the collection of twigs, leaves and other debris over the tube sheet, thus blocking off the flow of water through a portion of the tubes. Where this condition is encountered and where it is found impossible or impractical to screen the cooling water, the equipment should be installed so that the flow can be reversed in the tubes or so that the tube sheets can be blown clean with compressed air.

The soft deposits present the greatest resistance to heat flow. Such deposits are porous and allow the liquid in the tube to reach the metal. The resistance to heat flow is not caused so much by the solid matter as it is by the stagnant layer or film of liquid caused by the dirt deposit. It is for this reason that the resistance of this film depends to a considerable extent on the conductivity of the fluid. This is better understood when we consider that the conductivity of water is about .35 and of oil about .075, while a hard scale may have a conductivity higher than 1. It is believed by some that the thickness of these soft deposits, and thus the value of the fouling factor, increases with a decrease in Reynolds' number. Gronbeck[2] recommends that a correction factor be applied to the fouling resistance as indicated by Curve No. 1. He also presents a chart for estimating a fouling factor to use in design. (See Curve No. 2.)

Where dirt occurs on the shell side of the tubes, the problem of cleaning is not always easy. Heat exchange equipment may be designed so that cleaning on the outside may be done mechanically. Such provisions increase the overall price of the installation and decrease the initial efficiency. Some deposits occurring on tubes may be removed by a suitable solvent. It may be considered expedient to install permanent circulating systems for periodic cleaning of shell and tube equipment. Such systems, operated regularly, pay for themselves very quickly by eliminating long shut downs, labor costs for mechanical cleaning and maintain efficiency of the unit near its maximum.

The rapidity with which dirt may form on heat transfer surface was pointed out by Walter Samans[3] in a paper presented at a petroleum division meeting of the society in 1931. The heat exchanger code committee working under the auspices of

*Prepared for meeting, A.S.M.E., Tulsa.

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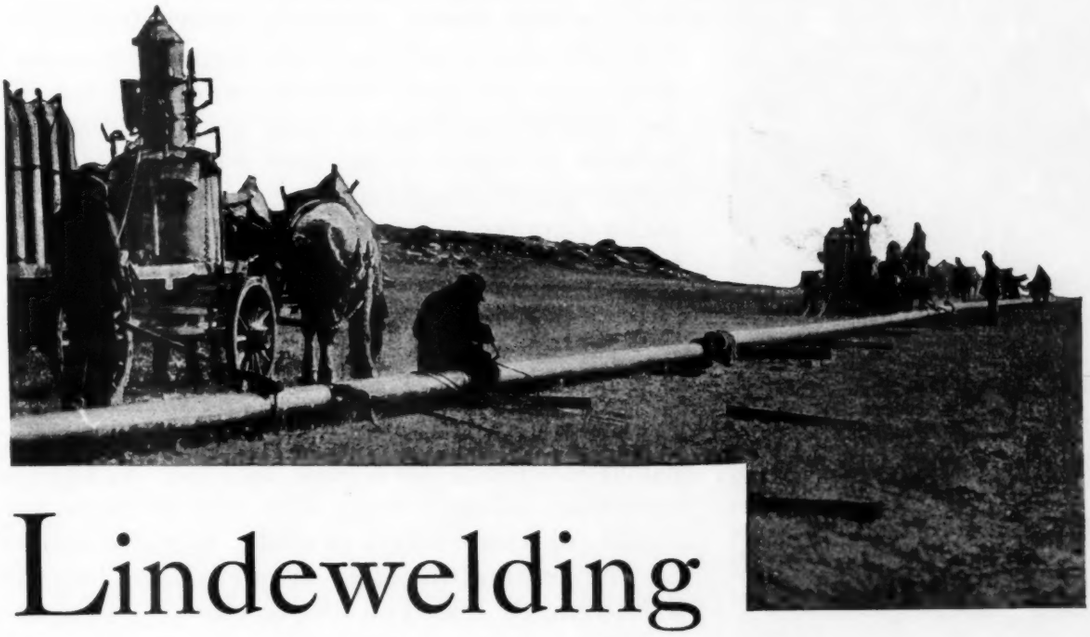

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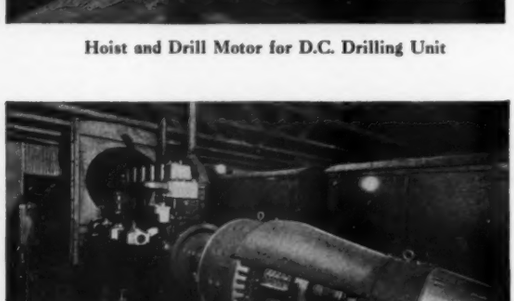

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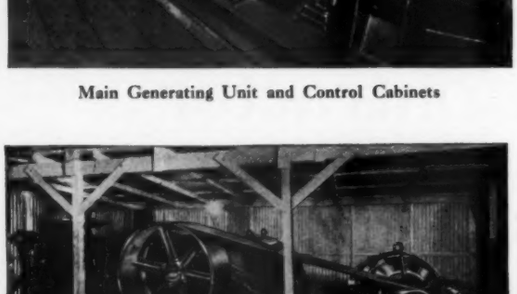

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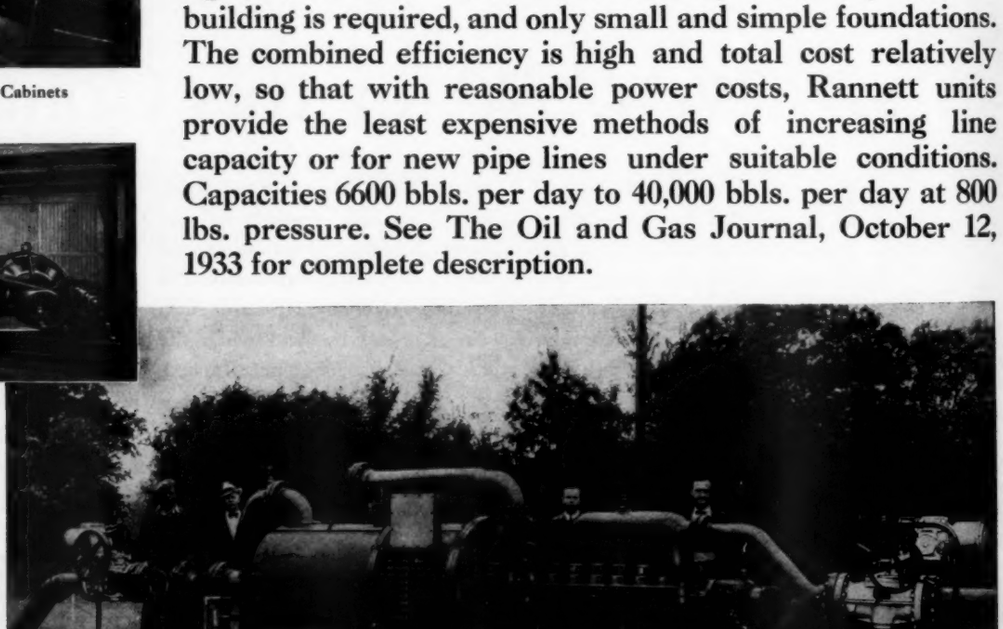

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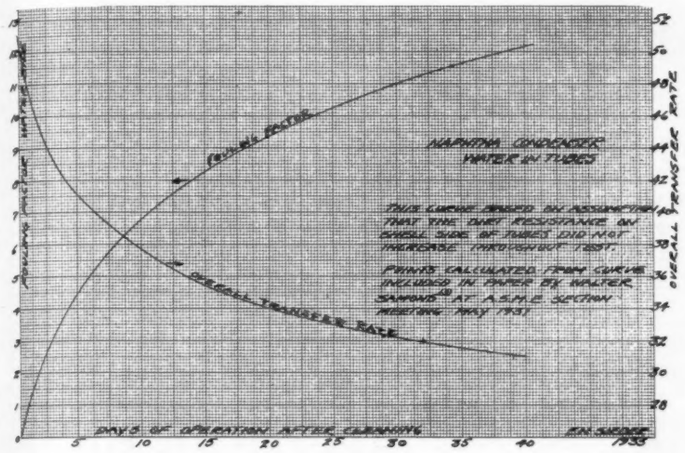
the petroleum division gave considerable thought to the matter of fouling, hopeful that some concrete recommendations could be made a part of the heat exchanger testing code. Lack of time and reliable data made this impossible, however. MacAdams in his book "Heat Transmission" devotes several pages to the effect of scale on evaporators.

Curves Indicate Variation

Several curves giving the results of tests known to the writer to be reliable are presented here to indicate the possible variation of the fouling factor with time. Each curve represents the effect of a different type of fouling.

Curve No. 3 for a naphtha condenser was made from a plot of transfer rate



Curve 3

against time, used by Mr. Samans to illustrate the paper mentioned above. Most of the dirt which caused the loss in efficiency was on the water side and in the form of a slimy film. Mud or slime such as this can be expected from rivers subjected to tidal variations such as the Schuylkill River in Philadelphia, and some of the creeks off the East River. The slowly decreasing slope of both the heat transfer curve and the fouling factor curve as time goes on might indicate that the dirtiness would reach a saturation point and the transfer rate become constant. This is believed to be the worst example of fouling due to dirty water which has come to the attention of the writer.

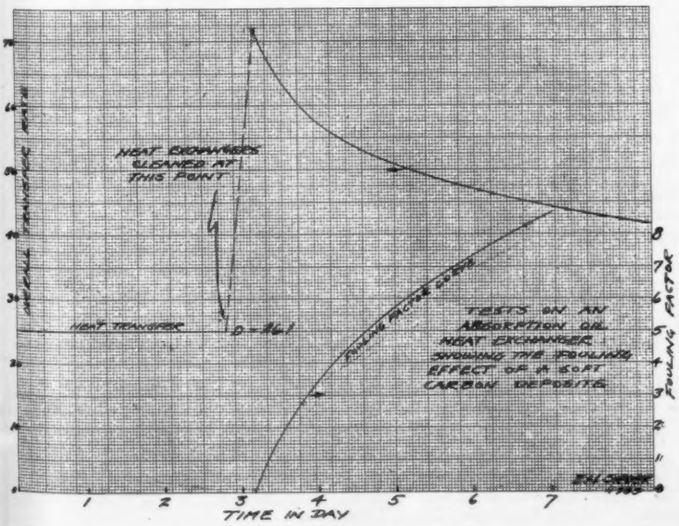
A severe type of fouling was encountered in a particular gasoline recovery plant. Preliminary tests indicate that the exchanger equipment, particularly the absorption oil heat exchangers were operating at very low transfer rates. Arrangements were made to circulate a cleaning fluid through both shell and tubes. Performance tests were made over a period of a week after the units had been put back on stream. Readings taken immediately after the cleaning showed a gain in heat transfer rate of almost threefold. However, signs of a recurrence of fouling could be noted after a few hours of operation. Curve No. 4 shows the results before and after a heat exchanger was cleaned. It may be noted that the fouling factor curve does not tend to flatten out as rapidly as the heat transfer curve. This can be understood from an examination of equation No. 5.

Plot No. 5 was made from tests taken on an evaporator. A mixture of water and dirty oil was heated in order to evaporate the water. The oil contained a large percentage of dirt in the form of lint. An inspection of the fouling factor curve indicates that the formation of the dirt film progressed at a constant rate.

Experience showed us, however, that this did not continue to the point where the tubes were plugged. Probably a balance was reached where the velocity of the oil increased to the point where no more dirt could collect.

Although the fouling shown on this curve might be considered very severe, it is not as bad as that which took place in the absorption oil heat exchanger, Curve No. 4.

In order to show more clearly the effect on overall heat transfer rates when a given amount of fouling is present, Curve No. 6 was prepared from equations 5 and 7. The decreasing effect of fouling as heat transfer rates decrease is clearly shown on this curve.



Curve 4

We can draw several conclusions from the equations and curves included in this paper.

First, it is basically unsound to provide for fouling in heat exchanger design by adding surface in the form of a percentage.

Second, the effect of fouling can be considered as an added resistance.

Third, fouling on each side of the transfer surface should be considered separately and are additive when expressed in the form of a fouling factor.

Where severe fouling conditions are expected economies in first cost and operation can be made by a careful survey of the individual problem. The possible use of cooling towers or spray ponds as a source of clean cooling water, the erection of permanent systems for circulating a cleaning fluid or the proper design of heat exchange equipment to facilitate cleaning are points that should not be overlooked when considering the purchase of heat exchanger equipment.

It is hoped that both prospective users and manufacturers of heat exchanger equipment adapt the term "fouling factor" to indicate the amount of fouling to be provided for in the selection of transfer surface. A common basis such as this would tend to increase the common store of knowledge of the subject and would result in more reasonable offerings of surface.

Nomenclature

U_c = theoretical or clean tube overall heat transfer rate in B.t.u. per hour degree Fahrenheit square foot.

U_d = overall heat transfer rate with tubes in a dirty condition.

h_f = film transfer coefficient of either fluid.

D = fouling factor.

k = conductivity in B.t.u. per hour degree Fahrenheit foot.

t = thickness inches.

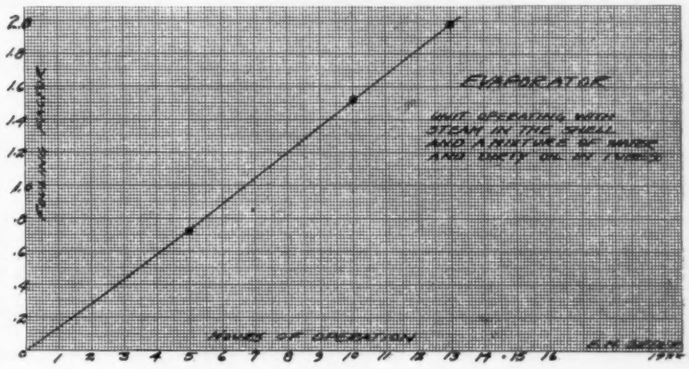
$\frac{DG}{u}$ = Reynolds criterion or turbulence factor where D = inside diameter of tube; G = mass velocity and u = viscosity. All expressed in constant units.

REFERENCES

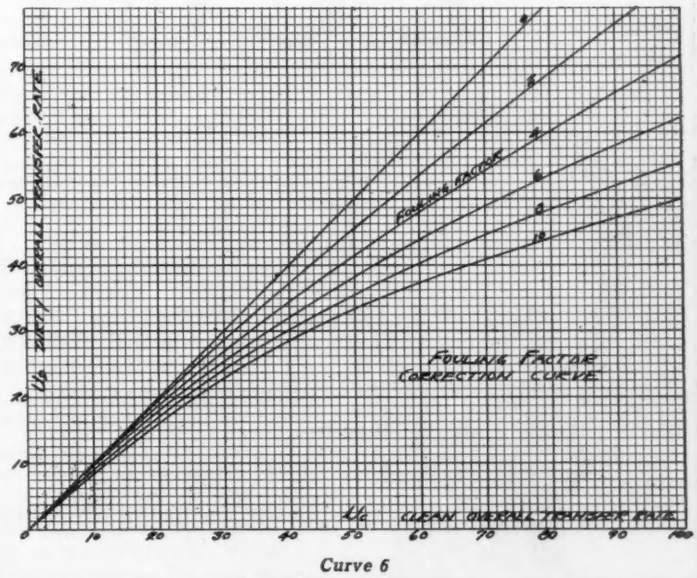
[1]Partridge: Formation and Properties of Boiler Scale, University of Michigan Eng. Research Bull. 16, 1930.

[2]Gronbeck: A.S.M.E. Heat Exchange Code Committee.

[3]Samans: Suggested Specifications for Testing Tubular Heat Transfer Equipment for Oil Refineries, Petroleum Refining meeting, Elizabeth, N. J., May, 1931.



Curve 5



Curve 6

B. C. TO AID DEVELOPMENT

Aggressive policies to encourage oil and gas development in the Fraser Valley area of British Columbia are forecast by the new British Columbia government which took office only a few months ago. Investigation into the oil possibilities of the Fraser Valley will be undertaken immediately as part of the government's program.

A. Wells Gray of New Westminster, minister of lands, has called for a full report on the geological formations, following a visit to the new oil and gas field in Bellingham, Wash., where similar geological conditions are believed to exist.

Private drilling operations are already in progress in the Fraser Valley; and government officials indicate that active assistance will be given to this work. A special powers act passed at the recent session of the British Columbia legislature gave the government of the province wide latitude in the disposition and regulation of the province's natural resources with a view to bringing about improved economic conditions.

Why so UNIFORM ?

IT IS Roebling's custom method of making welding steel that does the trick...that enables Roebling to produce welding wire which is absolutely uniform in quality...bundle after bundle, carload after carload.

Special, pure melting stock to begin with. Small heats in Roebling open-hearth furnaces. Close, accurate control of every process. Steel custom-made specifically for welding purposes...that's the answer.

May we send you data and samples of both electric and gas types?

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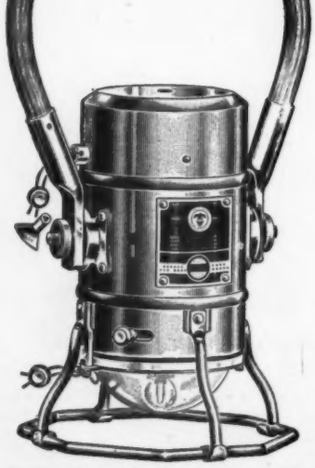
Welding Wire Distributors for Oil Fields
FRICK-REID SUPPLY CORPORATION
Pittsburgh, Pa. Tulsa, Okla. Houston, Texas

ROEBLING *Custom-Made* WELDING WIRE

FOR EXACTING WELDERS

ECOLITES

ECOLITE



ECOLITE—42-BM—carries the added approval of the U. S. Bureau of Mines (Permissibility No. 1012). It is provided with tamper-proof lock and seals.

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U. S. BUREAU OF MINES (Permissibility No. 1012)
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UNDERWRITERS' LABORATORIES (Class 1 Group D E 10481) FOR USE IN ALL HAZARDOUS LOCATIONS

BOTH MODELS HAVE TWO OUTSTANDING IMPROVEMENTS:

1. Now equipped with focusing reflectors, providing maximum illumination—piercing spot beam and wide-area horizontal light at one time.
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NOTE: We recommend for brilliant light the 5 volt .3 ampere G-4½ lamp bulb. Gives efficient, economical battery service.

STOCKED BY LEADING OIL WELL SUPPLY STORES

WRITE FOR DETAILS

ECOLITE—40-UV—is approved by Underwriters' Laboratories (Class 1 Group D) and is standard with most major oil companies for all divisions.

ECONOMY ELECTRIC LANTERN CO. Inc., 325 W. Huron St., Chicago, Ill.

(See our exhibit, Booth 15, Texas Building, International Petroleum Exposition, Tulsa, Oklahoma.)

Retiring Thickness of Oil Refinery Equipment and Hazards Which Have an Important Bearing

By F. L. NEWCOMB
Standard Oil Development Co., Elizabeth, N. J.*

In determining the retiring thickness of any piece of refinery equipment, a number of factors are involved. One must consider first, the character and inherent hazards of the contents of the equipment, second, the pressure and temperature involved, third, the possibility of external strains and their effect on the equipment, and fourth, the equipment itself including the type of construction and the materials of which it is made.

The character and inherent hazards incident to the contents of refinery equipment are many and varied. Oils of high viscosity, low gravity and high flash present only a small inherent hazard. They do not leak as readily as lighter stocks, are hard to ignite and do not vaporize readily. Oils of low viscosity, high gravity and low flash leak more readily, ignite easily, vaporize freely and the vapors may spread over considerable distances and thus reach sources of ignition. Most petroleum gases are heavier than air, spread rapidly, and if they reach a source of ignition may explode violently over a great area. Acids handled will cause serious burns, destroy steel and concrete and may cause failure of adjoining equipment long after they have been spilled and soaked into the ground. Caustic solutions are hazardous to personnel, causing serious burns. It would appear that the greater the inherent hazard, the more care must be taken to prevent even small losses and leaks and this will influence the retiring thickness.

Pressure and Temperature

The pressure and temperature involved are large factors in determining the retiring thickness. The pressure may not only cause a failure of the equipment, but also affects the amount of the contents which will be discharged through a leak and also the distance it may spread from the equipment. The temperature involved may affect the strength of the material of which the equipment is constructed and in addition may have a decided effect in determining the inherent hazard of the contents of the equipment. An oil, which at atmospheric temperature is well below its flashpoint and has little tendency to vaporize, may be at a high enough temperature to be easily ignited and to vaporize freely. Therefore the maximum pressure and temperature involved must be well known when determining the retiring thickness.

External strains may come from many causes and their effects may be considerable. A fired vessel with heat applied to only a portion of its surface may have large stresses set up due to unequal expansion. The deposition of coke in parts of a vessel and not in others may have the same result. Expansion of piping due to temperature may cause deflection resulting in bending stresses or may cause serious stresses to be set up in fittings. Supporting lugs may cause localized stresses. Pulsating pressures due to reciprocating pumps may cause impact or vibration, either of which will set up additional stresses. All strains similar to these must be considered in determining the retiring thickness.

The type of construction and the materials entering into the construction of a piece of equipment are important factors. The type of construction will determine the magnitude of the stress set up for a given set of conditions. A flat head will have a higher stress than an elliptical head of the same thickness under the same conditions of pressure and temperature. The type of a joint affects its efficiency. The straight length of pipe between expansion bends must act as a column carrying a load sufficient to cause the necessary deflection of the bend and the ratio of its length to its radius is a determining factor in the amount of deflection which will occur and the bending stress which will be set up. Materials vary in strength, ductility, resistance to shock and other characteristics. A rolled plate is more uniform in all characteristics than a cast material. All of these are important considerations in determining the retiring thickness.

Due to the various factors entering into a determination of the retiring thickness for oil refinery equipment, it is not possible to set down a table of limits covering a multiplicity of equipment. It is, however, possible to outline the methods employed in typical cases.

Pressure Vessels

Shortly, the American Petroleum Institute and the American Society of Mechanical Engineers will jointly issue "Rules for the Design, Construction, Inspection and Repair of Unfired Pressure Vessels for Petroluem Liquids and Gases." These rules cover both riveted and welded construction and state in considerable detail the conditions which must be considered in formulating the design. They include a set of curves showing the maximum allowable working stresses in tension, bearing and shear for carbon steel plates, forgings and castings at temperatures from 0° F. to 1,000° F., expressed as per cent of the ultimate strength in tension at atmospheric temperature of the material being used. These rules require that a pressure vessel shall not be used at any less thickness than required by the design formulas for the conditions prevailing in the quipment. They call for the use of

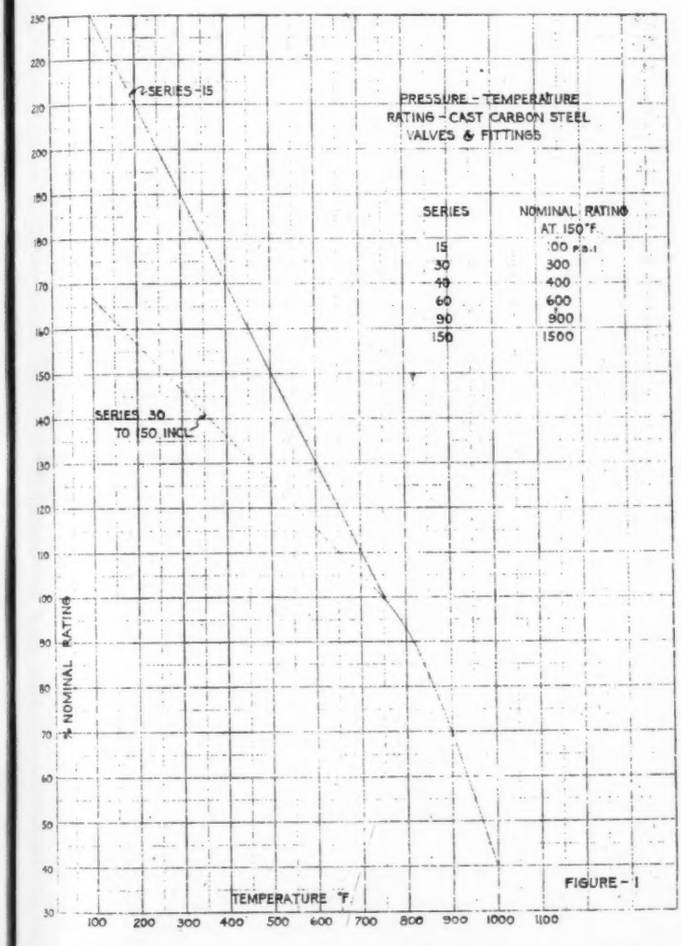


FIGURE - 1

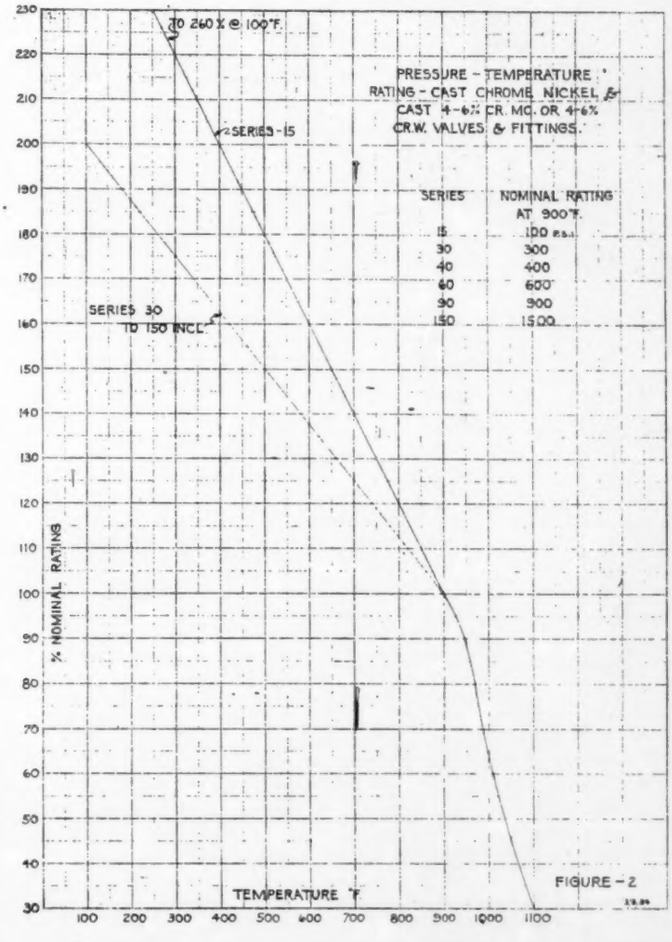
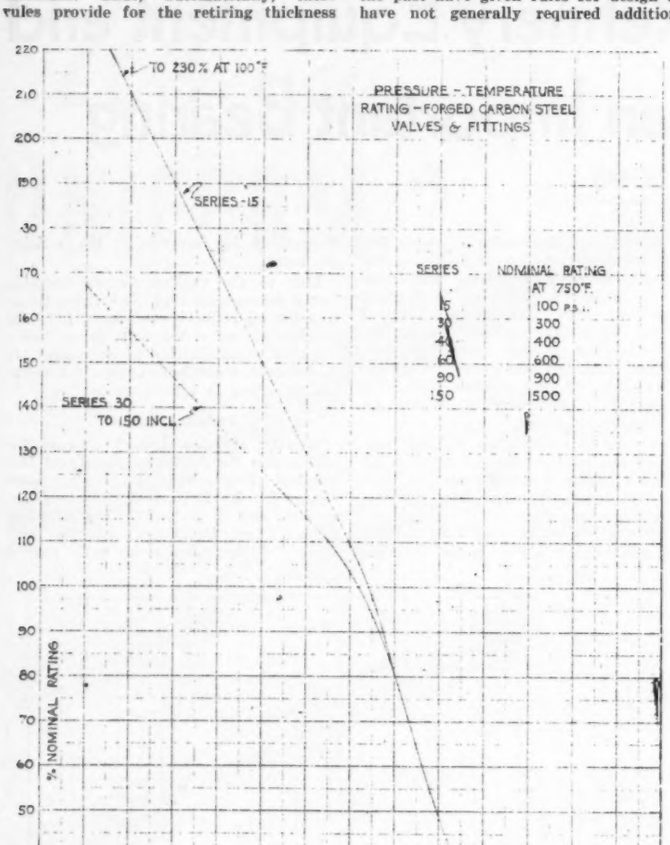


FIGURE - 2

*Before meeting A.S.M.E., Tulsa.

additional metal over the thickness required by the design formula, to care for corrosion. Thus, automatically, these rules provide for the retiring thickness of a pressure vessel, or reduction in pressure and/or temperature. Other codes in the past have given rules for design but have not generally required additional thickness for corrosion and have not specifically stated whether or not a vessel must be retired at the design thickness or whether it could be permitted to corrode to some lesser thickness. The inference naturally would be that the design thickness was the minimum thickness permissible for safe operation but still there has been room for argument and evasion. All too often in the past many



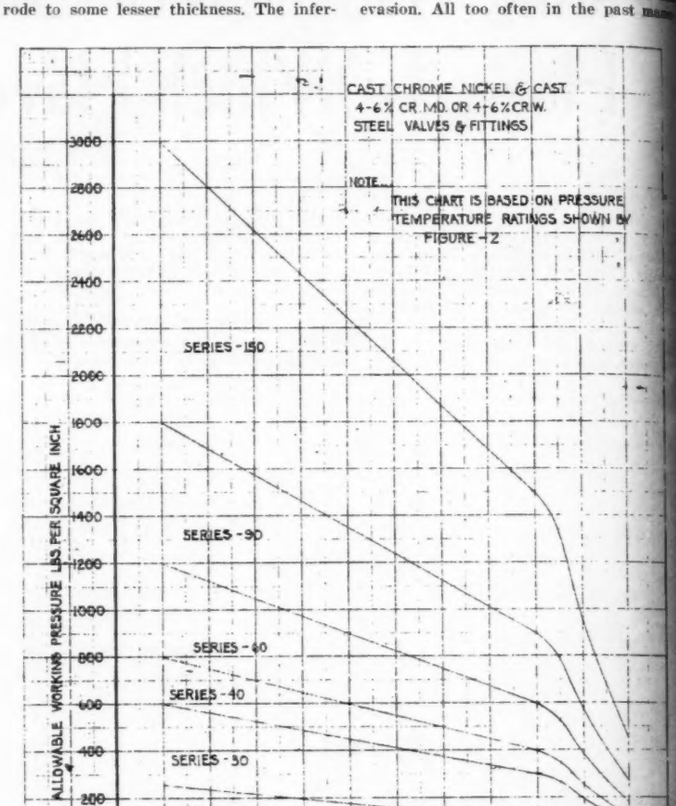

CAST CHROME NICKEL & CAST 4-6% CR. MO. OR 4-6% CR W. STEEL VALVES & FITTINGS
NOTE... THIS CHART IS BASED ON PRESSURE TEMPERATURE RATINGS SHOWN BY FIGURE - 2
SERIES - 150
SERIES - 90
SERIES - 60
SERIES - 40
SERIES - 30
SERIES - 15
ALLOWABLE WORKING PRESSURE LBS. PER SQUARE INCH.
TEMPERATURE - DEGREES FAHRENHEIT

Figure 5

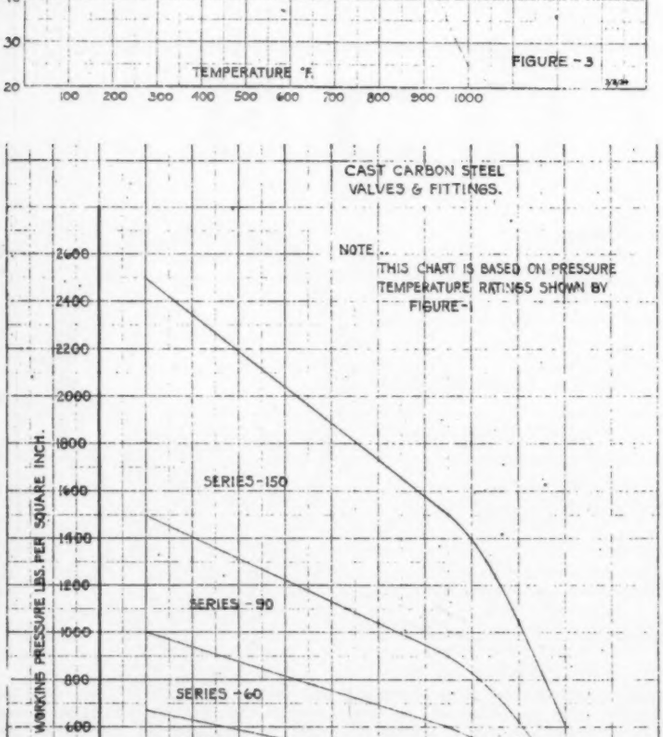

CAST CARBON STEEL VALVES & FITTINGS.
NOTE... THIS CHART IS BASED ON PRESSURE TEMPERATURE RATINGS SHOWN BY FIGURE - 1
SERIES - 150
SERIES - 90
SERIES - 60
SERIES - 40
SERIES - 30
SERIES - 15
ALLOWABLE WORKING PRESSURE LBS. PER SQUARE INCH.
TEMPERATURE - DEGREES FAHRENHEIT

Figure 4

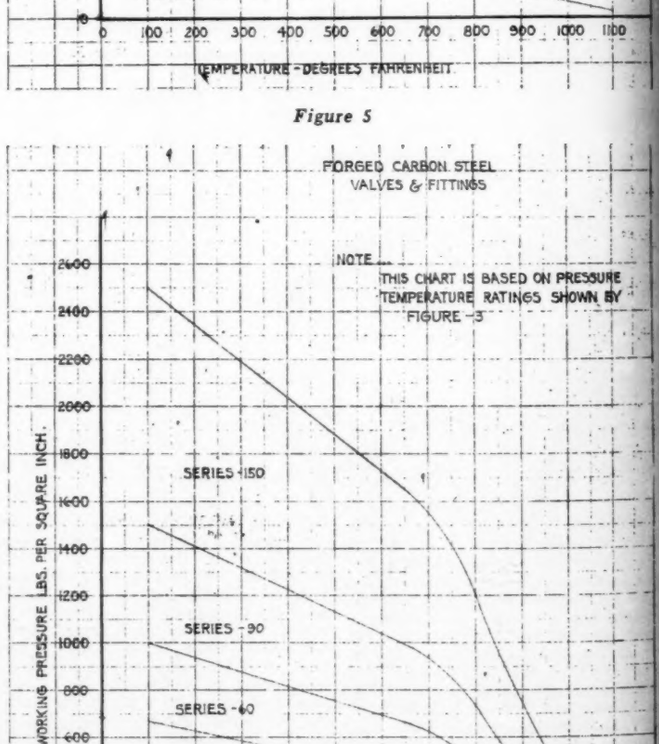

FORGED CARBON STEEL VALVES & FITTINGS
NOTE... THIS CHART IS BASED ON PRESSURE TEMPERATURE RATINGS SHOWN BY FIGURE - 3
SERIES - 150
SERIES - 90
SERIES - 60
SERIES - 40
SERIES - 30
SERIES - 15
ALLOWABLE WORKING PRESSURE LBS. PER SQUARE INCH.
TEMPERATURE - DEGREES FAHRENHEIT

Figure 6

AT LAST!
AN ALUMINUM PAINT
THAT STAYS BRIGHT
And Gives You 7 Other
Cost Cutting Advantages
EVERYWHERE, when tank maintenance is discussed, oil men are talking about a unique "super-aluminum" paint. And no wonder! For when you buy an aluminum paint you do it to protect an investment, save money. And this new-type paint is proved, not only to save you far more money, but also to give you a much brighter, better-looking job.
This development is called "Silvr-Cool." It is not "new" . . . not an "experiment." Already many of the largest marketers and producers in the industry are standardized on it. One company alone has used it on tankage of over twelve million barrels capacity. Everywhere, from Australia to Canada, from China to Venezuela, it is cutting costs, saving money.
"Silvr-Cool" is made with a special aluminum-bronze powder, super-polished, extra fine. The vehicle and mixing method used are Degraco secrets. Tests by oil men prove that "Silvr-Cool" leafs more uniformly, stays brilliant much longer, reflects heat and controls temperature as much as 32% better than ordinary aluminum paint! Even turns away destructive ultra-violet rays after many years of exposure to sulphur compounds and hydro-carbons!
"Silvr-Cool" may be applied either by hand-brush or air-spray. It efficiently covers fully 650 sq. ft. per gallon. It works easily and is easily put on by common labor. It's one of the extensive line of money-saving paints developed by the 50-year-old Degraco organization. Complete details about "Silvr-Cool" will be sent without obligation. Also the new Degraco "Easy-Way" paint chart is offered FREE—shows the best type of paint for any job. Write today.
DETROIT GRAPHITE CO., 536 TWELFTH ST., DETROIT, MICH.
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VARNISHES
ENAMELS

facturers furnishing competitive equipment have failed to make any adequate provision for corrosion and the operator of the equipment has shortly been faced with reduction in pressure or even loss of the equipment due to its deteriorated condition.

In addition to the provisions for new vessels, the A.P.I.-A.S.M.E. unfired pressure vessel rules carry an appendix covering the initial inspection and maximum allowable working pressure of vessels in service prior to the formulation of these rules.

It is the opinion of the writer that these rules have been carefully compiled and are fair and reasonable. They will, undoubtedly, result in the discard of poorly designed, unsafe equipment. They need no amplifications and appear to adequately cover the question of the proper retiring thickness for pressure vessels for petroleum liquids and gases. In the absence of any other regulation they might well be applied to any pressure vessel used in the petroleum industry.

The determination of retiring thickness for vessels which do not come under the classification of pressure vessels, is not so easily dealt with. A large part of such low pressure equipment may have intermediate stresses far in excess of the determinate stresses. Therefore the proper retiring thickness must necessarily be a matter of judgment and experience.

Atmospheric Equipment

There is a great deal of equipment in an oil refinery commonly referred to as "atmospheric equipment." Most of this operates at anywhere from an inch or so of water vacuum to several pounds pressure and at various temperatures up to 800° F. Storage tanks are not intended to be included in this category. In general it would appear that if this equipment has a thickness equal to that required by pressure vessel formulas for 10 to 15 pounds pressure, does not show signs of leakage during operation and gives no evidence of distortion at its supporting points due to the weight carried while in operation, it is probably thick enough to continue in operation.

Vacuum Equipment

A limited amount of equipment in oil refineries operates under a considerable vacuum. It is essential that such equipment remain tight since leakage will tend to destroy the vacuum and may cause internal fires which will overheat the vessel and cause considerable damage. Also a vacuum vessel is liable to collapse due to the external air pressure unless of sufficient thickness. The thickness required depends on the amount and arrangement of internal bracing. Usually the designer is the best qualified to state the minimum permissible thickness and should be requested to supply this information. If corrosion is to be expected, a liberal allowance should be added to the minimum required thickness so as not to uneconomically limit the life of the equipment.

Storage Tanks

Storage tanks are used extensively in all oil refineries. It has been the writer's experience that most peope think a storage tank will last almost indefinitely. All tanks are subject to a certain amount of corrosion. Those handling finished stocks are subject only to slight internal corrosion and such external corrosion as may occur due to atmospheric and soil conditions. Other tankage handling sour crudes and distillates may be subject to quite rapid corrosion. Most tankage, due to its large size, must necessarily be built with a comparatively small factor of safety. There appears to be very little published information available concerning a retiring thickness and yet, due to the large volume of oil contained in a tank, a failure may be disastrous. Recently considerable thought has been given by the writer and his associates to the proper retiring thickness for storage tanks. It appeared to be the consensus of opinion that the minimum thickness of a tank for oil storage should be that which would give a factor of safety of two when the tank was filled with water. In such case, when the tank is filled with a heavy, high flashpoint oil the factor of safety will approach two and the material of which the tank is constructed will be stressed close to its yield point. When the tank is filled with a lighter, more volatile oil the factor of safety will become greater and the material of which the tank is constructed will carry a lesser stress. Thus the more hazardous oils would be stored under the safer conditions of lower unit stress.

Piping, Valves and Fittings—General

Piping, valves and fittings play such an important part in an oil refinery that the question of a proper retiring limit is a large problem. They are used in all combinations of pressure and temperature, starting with very low pressures and atmospheric temperature and ranging upwards to pressures over 1,500 pounds and temperatures over 1,000° F. In one specialized process the pressure runs well over 3,000 pounds combined with temperatures in excess of 800° F. This latter case is, however, a special one and need not be considered here.

There has been little to guide one in the past, either in the selection of the proper material or in determining a suitable retiring thickness. There have been several manufacturer's recommendations concerning valves and fittings, but they have not been in agreement with each other. However, there is now in course of preparation, under the auspices of the American Standards Association, an "American Standard Code for Pressure Piping." It is expected that this code will be issued shortly as A.S.A. Standard B31–. It represents a standard of minimum requirements and will contain one section on oil piping and others dealing with other industrial piping as well as fabrication details and material specifications. It will apply only to new work and will not cover retiring thicknesses.

The above mentioned code will give pressure-temperature ratings for the various classes of valves, fittings and pipe.

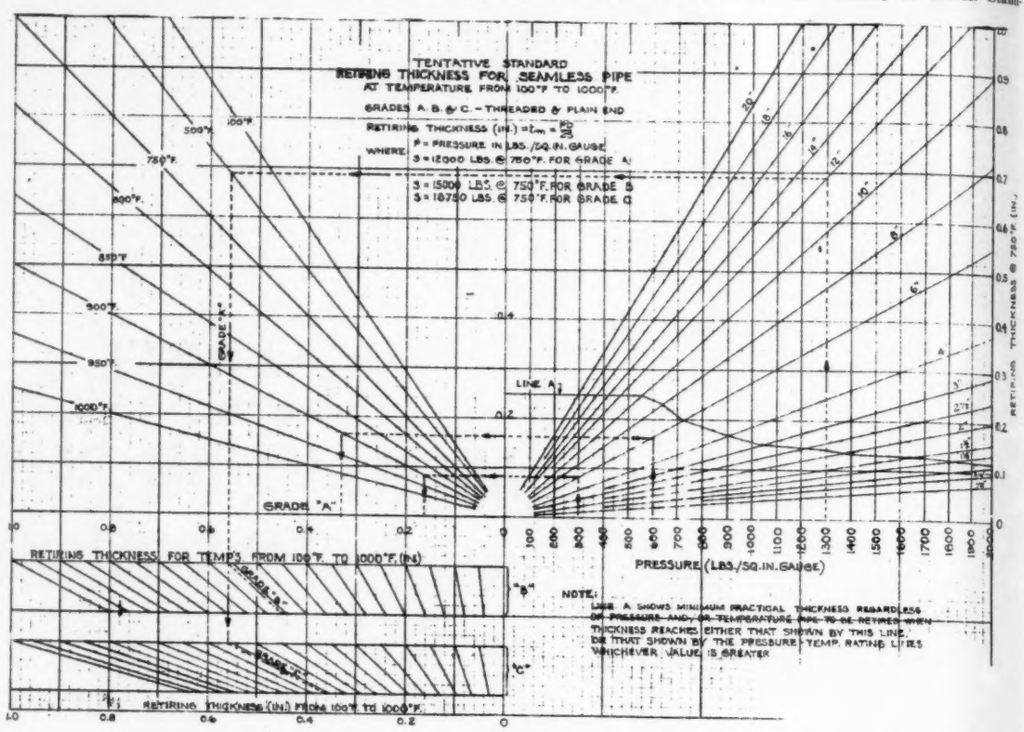
TENTATIVE STANDARD
RETIRING THICKNESS FOR SEAMLESS PIPE
AT TEMPERATURE FROM 100°F TO 1000°F.
GRADES A, B, & C - THREADED & PLAIN END
RETIRING THICKNESS (IN.) = $t_m = \frac{PD}{2S}$
WHERE
P = PRESSURE IN LBS./SQ.IN. GAUGE
S = 12000 LBS. @ 750°F. FOR GRADE A
S = 15000 LBS. @ 750°F. FOR GRADE B
S = 18750 LBS. @ 750°F. FOR GRADE C
100°F.
500°F.
750°F.
800°F.
850°F.
900°F.
950°F.
1000°F.
GRADE "C"
GRADE "B"
GRADE "A"
LINE A
RETIRING THICKNESS FOR TEMPS. FROM 100°F. TO 1000°F. (IN.)
RETIRING THICKNESS (IN.) FROM 100°F. TO 1000°F.
PRESSURE (LBS./SQ.IN.GAUGE)
RETIRING THICKNESS @ 750°F. (IN.)
NOTE:
LINE A SHOWS MINIMUM PRACTICAL THICKNESS REGARDLESS OF PRESSURE AND/OR TEMPERATURE PIPE TO BE RETIRED WHEN THICKNESS REACHES EITHER THAT SHOWN BY THIS LINE OR THAT SHOWN BY THE PRESSURE-TEMP. RATING LINES WHICHEVER VALUE IS GREATER

Figure 9

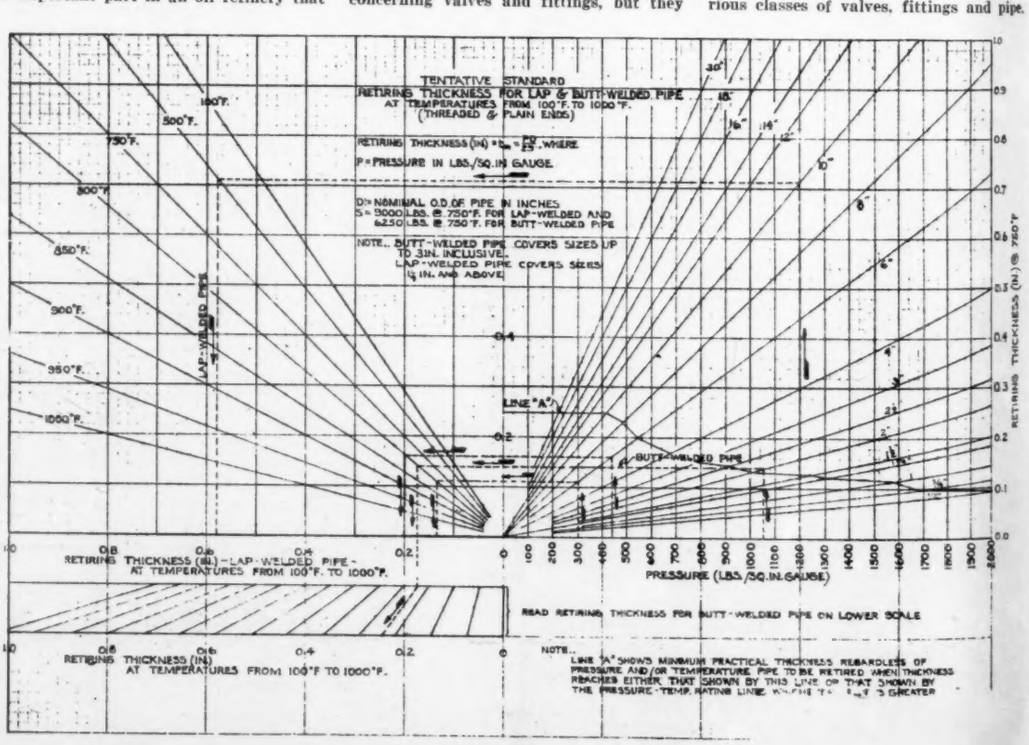
TENTATIVE STANDARD
RETIRING THICKNESS FOR LAP & BUTT-WELDED PIPE
AT TEMPERATURES FROM 100°F. TO 1000°F.
(THREADED & PLAIN ENDS)
RETIRING THICKNESS (IN.) = $t_m = \frac{PD}{2S}$ WHERE
P = PRESSURE IN LBS./SQ.IN. GAUGE
D = NOMINAL O.D. OF PIPE IN INCHES
S = 9000 LBS. @ 750°F. FOR LAP-WELDED AND 6250 LBS. @ 750°F. FOR BUTT-WELDED PIPE
NOTE.. BUTT-WELDED PIPE COVERS SIZES UP TO 3 IN. INCLUSIVE.
LAP-WELDED PIPE COVERS SIZES 4 IN. AND ABOVE
100°F.
500°F.
750°F.
800°F.
850°F.
900°F.
950°F.
1000°F.
LAP-WELDED PIPE
BUTT-WELDED PIPE
LINE "A"
RETIRING THICKNESS (IN.) - LAP-WELDED PIPE - AT TEMPERATURES FROM 100°F. TO 1000°F.
PRESSURE (LBS./SQ.IN.GAUGE)
RETIRING THICKNESS @ 750°F. (IN.)
READ RETIRING THICKNESS FOR BUTT-WELDED PIPE ON LOWER SCALE
RETIRING THICKNESS (IN.) AT TEMPERATURES FROM 100°F. TO 1000°F.
NOTE.. LINE "A" SHOWS MINIMUM PRACTICAL THICKNESS REGARDLESS OF PRESSURE AND/OR TEMPERATURE PIPE TO BE RETIRED WHEN THICKNESS REACHES EITHER THAT SHOWN BY THIS LINE OR THAT SHOWN BY THE PRESSURE-TEMP. RATING LINES WHICHEVER VALUE IS GREATER

Figure 10

Based on what is now proposed for the code, certain curves have been drawn and are appended hereto. However, since the code has not been finally adopted and some of the data used in drawing these curves are still under discussion, they may be subject to change and should only be considered as tentative.

Valves and Fittings

Figures 1, 2 and 3 show pressure-temperature ratings of cast carbon steel, cast chrome-nickel and cast 4-6 per cent chrome-molybdenum or chrome-tungsten steel, and forged carbon steel, valves and fittings respectively. From these one can determine the maximum pressure for which any class of valve or fitting is recommended at any given temperature.

Figures 3, 4 and 5 are charts based on the pressure-temperature rating curves shown in Figures 1, 2 and 3, respectively. From these one can read directly the class of valve or fitting required for any combination of pressure and temperature and can also read directly the maximum recommended pressure for any valve or fitting at any temperature or vice versa. It is felt that these charts are easier to use than the pressure-temperature rating curves since no computations are necessary.

The curves and charts mentioned above cover the recommendations for valves and fittings as proposed for the oil piping section of the American Standard Code for Pressure Piping. Based on the pressure-temperature rating curves, the writer and his associates have prepared three charts (Figures 11, 12 and 14), covering proposed retiring thicknesses for valves and fittings. These retiring thicknesses are not to be a part of the code. Figure 11 is proposed for cast carbon steel valves and fittings. Figure 12 is proposed for cast chrome-nickel and 4-6 per cent chrome-molybdenum or chrome-tungsten steel valves and fittings. Figure 14 is proposed for forged carbon steel valves and fittings.

These tentative retiring thickness charts are based on the formula:

$$t_m = \frac{P\ D}{2\ S} \times 1.5$$

where:

t_m = Retiring thickness in inches—except as given in the table shown on the chart.

P = Maximum working pressure in pounds/square inch gauge.

D = Actual O.D. of pipe in inches, of the same nominal size as the fitting.

S = Allowable working stress in pounds/square inch.

For cast carbon steel valves and fittings (Figure 11) and for forged carbon steel valves and fittings (Figure 14) S = 7,000 pounds/square inch at 750° F. and is varied from this point, for other temperatures, in accordance with the percentages shown by the pressure-temperature rating curves in Figures 1 and 3, respectively.

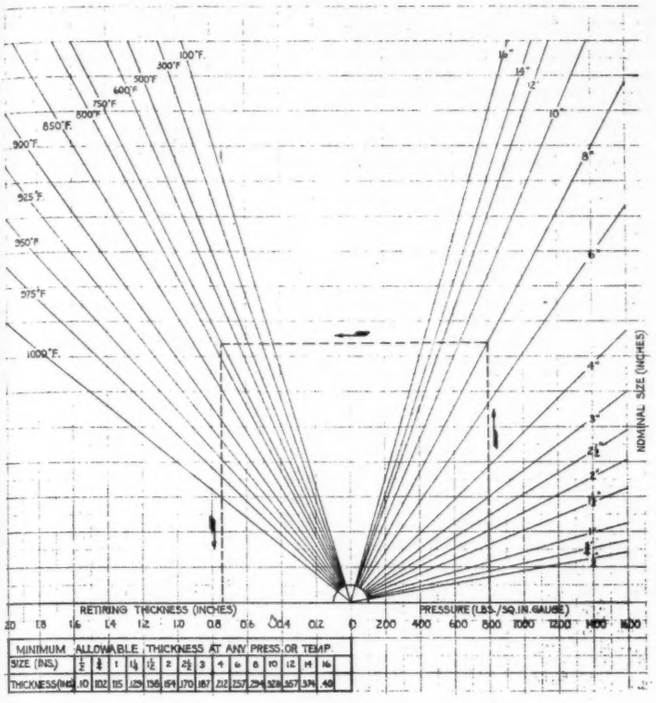

Figure 11

Tentative Standard Retiring Thickness for Cast Carbon Steel Valves and Fittings Series 15-150

t_m = PD/25 × 1.5 where
t_m = Retiring thickness in inches except as given in table.

P = Working pressure in lbs./sq. in. gauge.
D = Nominal O.D. of pipe in inches.
S = Stress of 7,000 lbs. at 900° F.

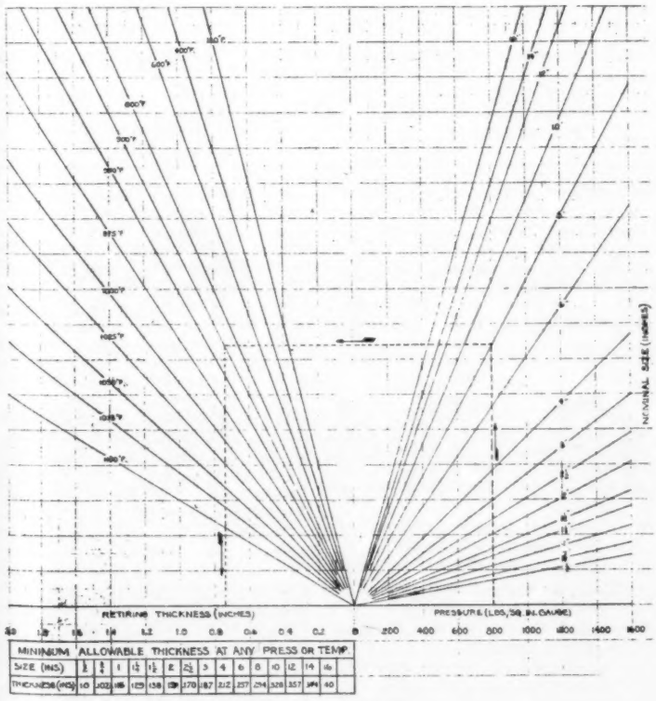

Figure 12

Tentative Standard Retiring Thickness for Chrome-Nickel and 4-6% Chrome Molybdenum (or Chrome-Tungsten) Steel Valves and Fittings

t_m = PD/25 × 1.5 where
t_m = Retiring thickness in inches except as given in table.

P = Working pressure in lbs./sq. in. gauge.
D = Nominal O.D. of pipe in inches.
S = Stress of 7,000 lbs. at 750° F.

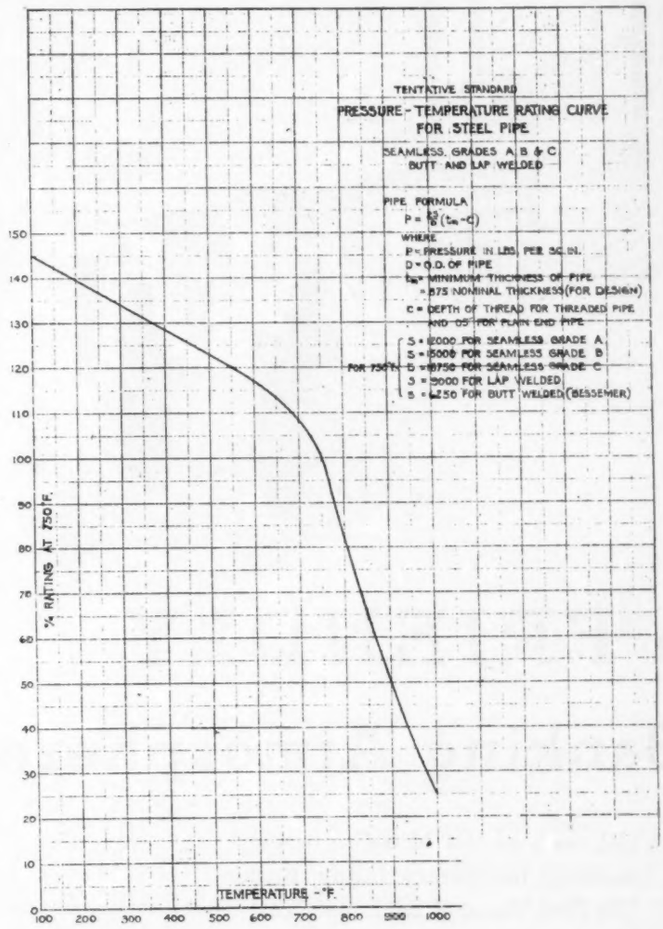
TENTATIVE STANDARD
PRESSURE - TEMPERATURE RATING CURVE FOR STEEL PIPE
SEAMLESS, GRADES A, B & C
BUTT AND LAP WELDED
PIPE FORMULA
P = 1/2 (t_m - C)
WHERE
P = PRESSURE IN LBS. PER SQ. IN.
D = O.D. OF PIPE
t_m = MINIMUM THICKNESS OF PIPE
= .875 NOMINAL THICKNESS (FOR DESIGN)
C = DEPTH OF THREAD FOR THREADED PIPE
AND 0.0 FOR PLAIN END PIPE
FOR 750°F.
S = 12000 FOR SEAMLESS GRADE A
S = 15000 FOR SEAMLESS GRADE B
S = 18750 FOR SEAMLESS GRADE C
S = 9000 FOR LAP WELDED
S = 7250 FOR BUTT WELDED (BESSEMER)
% RATING AT 750°F.
TEMPERATURE - °F.

Figure 13

For cast chrome-nickel and cast 4-6 per cent chrome-molybdenum or chrome-tungsten steel valves and fittings (Figure 12) S = 7,000 pounds/square inch at 900° F. and is varied from this point, for other temperatures, in accordance with the percentages shown by the pressure-temperature rating curve in Figure 2.

Since there are indeterminate stresses in valves and fittings due to line strains and other causes, it was felt that there should be an arbitrary minimum thickness below which a valve or fitting of given size should not be used, even though computations based on pressure and temperature would permit a lesser thickness. These minimum thicknesses are shown in a table at the bottom of each chart.

The use of the charts is illustrated by the dotted lines and arrows showing a typical example. Starting with the pressure required, a vertical line is followed until it intersects the inclined line corresponding with the valve or fitting size. A line is then followed to the left until it intersects the proper inclined temperature line and then vertically downward where the retiring thickness is read. If this thickness is greater than

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the minimum shown in the table for the same size valve or fitting, it should be used, otherwise, the minimum in the table should be taken as the retiring thickness.

Pipe

Figure 13 shows the pressure-temperature rating curve for steel pipe as proposed for the American Standard Code for Pressure Piping. It also shows the formula to be used in computing the required thickness, together with the allowable stress for the various grades of pipe. This applies to new work.

As in the case of valves and fittings, based on the pressure-temperature rating curve, two charts (Figures 9 and 10), have been prepared covering proposed retiring thicknesses for the various classes of pipe. These retiring thicknesses are not to be a part of the code.

Figure 9 covers seamless steel pipe, Grades A, B and C. Figure 10 covers welded pipe, both lap and buttwelded.

These retiring thickness charts are based on the formula

$$t_m = \frac{P\,D}{2\,S}$$

where:

t_m = Retiring thickness in inches, unless the arbitrary minimum is greater.

P = Maximum working pressure in pounds/square inch gauge.

D = Actual outside diameter in inches.

S = Allowable working stress in pounds/square inch.

S = 12,000 lbs./sq. in. @ 750° for Grade A Seamless.

S = 15,000 lbs./sq. in. @ 750° for Grade B Seamless.

S = 18,750 lbs./sq. in. @ 750° for Grade C Seamless.

S = 9,000 lbs./sq. in @ 750° for lapwelded.

S = 6,250 lbs./sq. in. @ 750° for buttwelded.

"S" is varied for other temperatures in accordance with the percentages shown by the pressure-temperature rating curve in Figure 13.

Since piping has indeterminate stresses set up by expansion and contraction, vibration, bending between supports and other causes, it was felt that there should be an arbitrary minimum thickness below which pipe of a given size should not go. These minimum thicknesses are shown by the irregular line "A" crossing the pipe size lines at the right of the charts.

The use of the charts is illustrated by dotted lines and arrows showing typical examples. The procedure is the same as in the use of the retiring thickness charts for valves and fittings.

The chart in Figure 9 gives the retiring thickness for Grade "A" pipe directly. To determine the retiring thickness for Grades "B" or "C" it is necessary to divert to the right as indicated by the inclined lines bracketed below for the grade under consideration.

The chart in Figure 10 gives the retiring thickness for lapwelded pipe directly and to determine the retiring thickness for buttwelded pipe it is necessary to divert to the left as indicated by the inclined lines bracketed below.

If the thickness determined by the chart is greater than the minimum shown by line "A" for the same size pipe, it should be used, otherwise the minimum shown by line "A" should be taken as the retiring thickness.

The writer has endeavored to cover methods for determining the retiring thickness of the more common equipment used in an oil refinery. Owing to the large field covered, it has not been possible to give specific limits. In the case of valves, fittings and pipe, where sizes are standardized, some approach has been made to specific limits but even there, owing to the fact that the pressure-temperature rating curves are still in course of formation, the limits shown can only be considered tentative. It is hoped that this paper will be of some assistance to those charged with the maintenance of equipment, in arriving at retiring limits, and to those charged with designing or obtaining new equipment, in specifying allowances for corrosion.

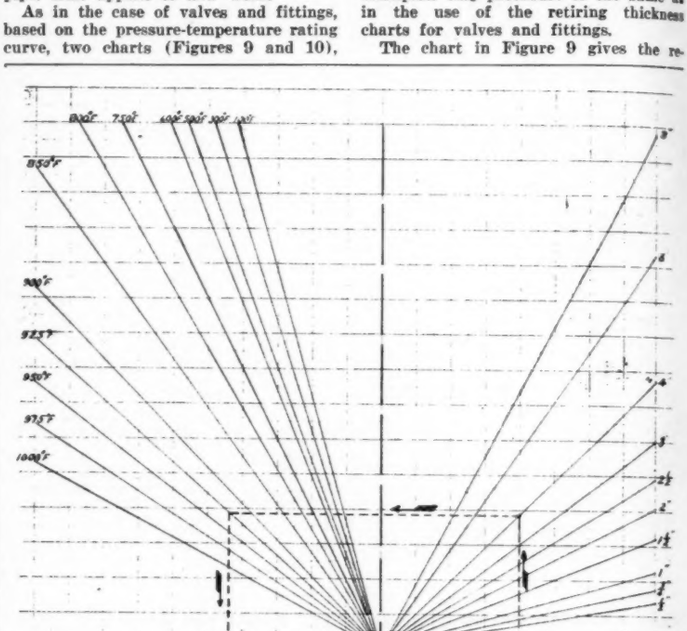

Figure 14

Tentative Standard Retiring Thickness for Forged Carbon Steel Valves and Fittings Series 15-150

t_m = PD/25 × 1.5 where
t_m = Retiring thickness in inches except as given in table.

P = Working pressure in lbs./sq. in. gauge.
D = Nominal O.D. of pipe in inches.
S = Stress of 7,000 lbs. at 750° F.

Effect of Diameter, Spacing, Etc. on Pressure Drop Around Tubes of Shell Type Heat Exchanger

By B. E. SHORT and T. F. STACK

Sponsored by the Bureau of Engineering Research and the Department of Mechanical Engineering, University of Texas*

There are considerable data available on the friction losses of fluids flowing in circular pipes which are generally accepted as the basis of calculations for the design of new fluid conveyors of that type. Recently, data have been presented which show the friction losses for fluids moving in annular pipes and for fluids flowing at right angles to tube bundles.

Since, from the data for circular pipes, friction coefficients, or factors, for use in Fanning's equation have been generally adopted, these experiments were performed for the purpose of obtaining data to permit the application of the accepted friction factor data to fluid friction losses in the baffled tube bundles of a shell and tube type heat exchanger.

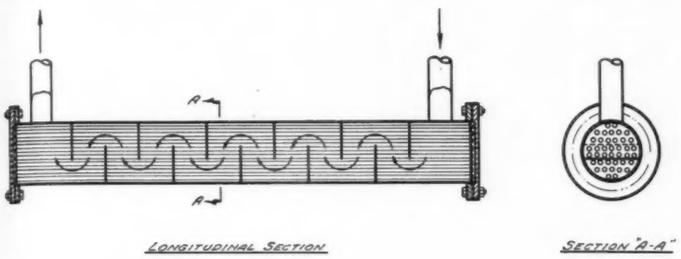

Figure 1

Scope

These data were obtained from a heat exchanger shell with tube bundles of the following tube diameters and tube spacings:

Tube diameter	Tube pitch
5/16"	⅜" and ⅝"
⅜"	7/16", ½", 19/32", 0.65", ¾"
7/16"	19/32", 11/16", ¾"

With each combination of tube diameter and tube pitch, data were obtained with 0, 3, 5, 7, 11 and 15 baffles (with the few exceptions as shown by the data sheets) spaced equally in the total length of 22.75 inches. Then, for each bundle thus arranged (i.e., a total of 52 bundles), the loss in pressure at entrance and exit and the total loss across the shell were obtained for a wide variation in the rate of flow.

After obtaining these data, they were correlated and interpreted on the basis of the variables in circular pipes in order to obtain a common working principle. That is, relations were presented for obtaining an "average" velocity of the fluid and the equivalent diameter of the passage of flow.

Apparatus and Procedure

The experimental exchanger consisted of brass tubes five-sixteenths inch, three-eighths inch and seven-sixteenths inch in diameter assembled in bundles which were inserted in the 4-inch standard steel pipe shell as shown in Figure 1. The total number of tubes used in each bundle was the maximum that could be placed into the shell for the particular tube diameter and tube pitch since, in the design of an exchanger, the diameter of the shell and the area of the total transfer surface are generally proportional so that the tubes will be equally distributed over the cross section of the shell for the designed rate of flow. "Half-moon" baffles (Figure 2) were placed on the bundle with the flat edge horizontal as shown by Figure 1. These baffles were placed at equal intervals along the tubes in the total distance of 22.75 inches. An uneven number of baffles were used in each case so that the direction of flow into the tube bundle and past the first baffle and the direction of flow past the last baffle and out of the tube bundle would always be the same. Circular tube sheets were used at the ends to brace the ends of the tubes.

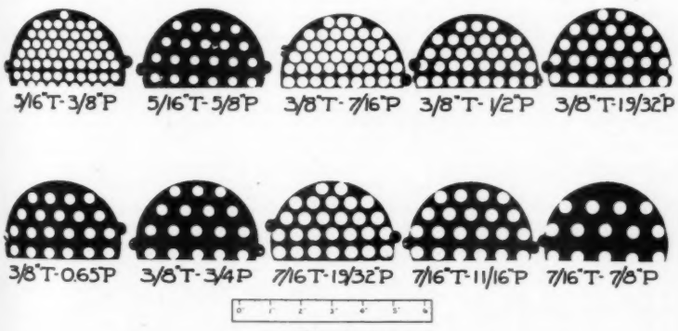

Figure 2

The tubes were soldered to these sheets and one end of the tubes was filled with solder to prevent flow through them. After each bundle was assembled, the baffles were fitted into the shell so that the leakage between them and the shell would be a minimum.

The water was circulated from the suction pit through the exchanger from which it passed through calibrated nozzles back into the pit. The quantity of water flowing through the shell was controlled by a valve on the discharge of the centrifugal circulating pump and by the pump speed.

The pressure losses at entrance and at exit and across the shell and the pressure head on the calibrated nozzles were obtained with mercury-filled U-tube manometers except for the higher rates of flow, in which case, a Bourden tube gauge was used for the measurement of the pressure head on the calibrated nozzles. A piezometer ring was placed on the discharge pipe above the calibrated nozzles and "piezometer manifolds" were constructed on the shell just beyond the point of entrance into the tube bundles and just before the point of exit from the bundles. The manometers and gauges were attached to these rings and manifolds.

With a particular bundle in place in the shell, the rate of flow was varied from a minimum value to a maximum value (maximum of 20 to 25 feet per second inlet and exit velocity in most cases) and the various pressures were obtained at each rate. Each rate of flow was maintained for a sufficient length of time to permit conditions to become stabilized with "check" readings being made where inconsistences in the trends were found. The increment of the rate of flow and the range of the rate were governed by the consistency of the data as well as by the indication of critical points.

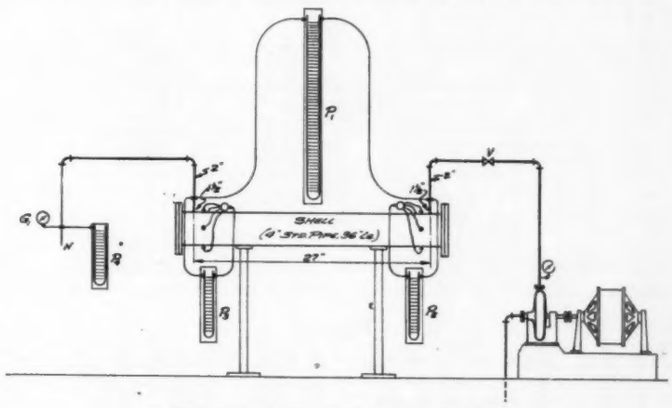

Figure 3—Arrangement of apparatus

Total Pressure Drop

The total drop in pressure in flowing through the shell and around the tubes of the exchanger includes the loss at entrance into the tube bundle, the loss due to fluid friction in flowing around the tubes in the bundle and the loss at exit from the bundle and the shell. In order to establish an accurate relation between the sum of the entrance and exit losses and the total pressure drop across the exchanger, these pressure losses were plotted as functions of the entrance and exit velocities. An example of these plots are shown by Figure 4. The sum of the entrance and exit losses for the bundle without baffles is shown by line E_0; while the sum of the entrance and exit losses for the bundle with baffles is shown by the line E_B. The total losses in pressure across the shell for the bundles with 0, 3, 7, 11 and 15 baffles are shown by lines T_0, T_3, T_7, T_{11} and T_{15}, respectively.

Net Pressure Drop

The net pressure drop as used in this discussion consists of the total drop in pressure minus the sum of the entrance and exit losses. That is, it is the pressure loss due to fluid friction as the water passes around the tubes and baffles inside the straight portion of the shell. The values of this quantity as used in the determination of the friction factor and in the development of the empirical formulae were obtained from

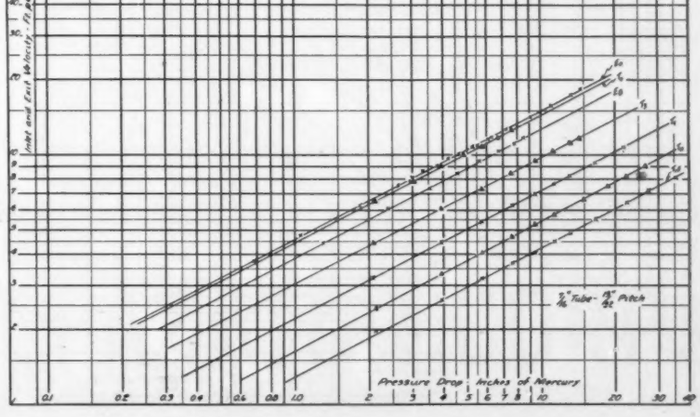

Figure 4

*Prepared for meeting of A.S.M.E., Tulsa.

the differences between the total pressure loss curves (T) and the sum of the entrance and exit loss curves (E) of the plots of which Figure 4 is an example.

Average Velocity

In correlating the data of these experiments with existing data on circular pipes, it was necessary to determine the average velocity of flow around the tubes and baffles in the shell that would correspond to the average linear velocity of a fluid flowing in a circular pipe. It was considered that the two components of the average or mean velocity of flow were the velocity of the fluid flowing parallel to the tubes (u_2) and the velocity of the fluid flowing perpendicular to the tubes (u_1).

For the bundle without baffles, it was assumed that the flow was parallel to the tubes from the point immediately following entrance into the bundle until the point immediately before exit from the bundle. These points are shown by Figure 3 as those where the "piezometer manifolds" are attached to the shell. This velocity was computed on the basis of the total flow through the shell and the "free" cross-sectional area of the shell (i.e., the area of the shell minus the sum of the external cross-sectional areas of all the tubes).

For the bundle with baffles, it was assumed that the perpendicular and parallel components were in proportion to the comparative distances traveled in a perpendicular direction in passing from the flat edge of one baffle to the flat edge of the succeeding baffle to the total longitudinal distance along the shell. That is,

$$\frac{N_b' A u_1^2}{B} + u_2^2 = (u_x)^2 \qquad (1)$$

where:

N_b' = the number of baffles minus one.

A = the distance (perpendicular to the tubes) from the edge of one baffle to the edge of the succeeding baffle.

B = the horizontal length of flow (22.75 inches for all cases), it being the distance between the two points of measurement along the tubes.

u_1 = the velocity of flow perpendicular to the tubes, ft. per sec.

u_2 = the velocity of flow parallel to the tubes, ft. per sec.

u_x = the average or mean velocity of flow, ft. per sec.

Since the fluid friction losses are proportional approximately to the square of the velocity and to the length of the path of flow, the net pressure loss along the tubes would be shown by the sum of the drop resulting from the flow perpendicular to the tubes between the baffles and the drop resulting from the flow parallel to the tubes in the segmental area between the flat edge of the baffle and the circular shell. In Equation 1, "A" represents the distance traveled in a perpendicular direction between each pair of baffles and "B" represents the total distance traveled in a parallel direction in the segmental area. The sum of the parallel distances through which the fluid moves in each segmental area is the total distance of flow along the tubes and, hence, is considered as the total length of the path of flow for the fluid moving at the velocity u_x. In order to obtain the total perpendicular distance of travel and to make an allowance for the increase in effective length of the path caused by the reversed directions of flow, the factor, N_b', was inserted. Since the number of passages between the baffles and the number of complete reversals are each equal to the number of baffles minus one, the factor, N_b', was given this value in each case. The component of flow perpendicular to the tubes was computed on the basis of the "free" area of flow perpendicular to the tubes in the space between each baffle considering only the central tube rows. The component of flow parallel to the tubes was computed for the "free" area of the circular segment between the flat edge of the baffle and the shell.

A direct arithmetical average of the two velocity components was used at first, but the consistent relations were not obtained in the use of this average that were obtained with the "computed" average. The net pressure drop for the 7/16" tube—19/32" pitch bundle plotted against the arithmetical average is shown by Figure 5 for each baffle combination used for this bundle. While Figure 6 shows the net pressure drop, for all the bundles with 11 baffles, plotted against the arithmetical average as well as against the "computed" average. When the arithmetical average velocity is used, a greater separation exists in the points for a particular tube diameter than is true for the "computed" average velocity.

Entry and Exit Losses

Since the velocity energy in the fluid entering the shell is the same as that leaving (entrance and exit passage the same size), it may be assumed that the sum of the entry and exit losses becomes a function of the velocity of the fluid parallel to the tubes during passage through the bundle. This assumption is justified by the fact that the entry and exit losses result largely from the turbulence produced by the increase or decrease in velocity and it is the velocity of the fluid parallel to the tubes to which the change must be referred from the inlet or exit velocity. Approximate equations for the sum of these losses with baffles and without baffles are shown below:

(with baffles)

$$\Delta p = 0.061\, u_2^2 \qquad (2)$$

(without baffles)

$$\Delta p = 0.385\, u_2^2 \qquad (3)$$

where:

Δp = the sum of the drops in pressure at the entrance into and exit from the shell and bundles, inches of mercury.

u_2 = the velocity of the fluid parallel to the tubes, ft. per sec.

The pressure loss at exit in both the baffled and unbaffled cases is greater than the loss at entrance due to the additive effect of the friction losses at exit and the loss due to the increase in velocity. At the entrance into the shell and tube bundles, the velocity is decreased in most of the tube bundles, thus producing a tendency to increase the static pressure with the resulting tendency to counteract the loss due to friction and change in

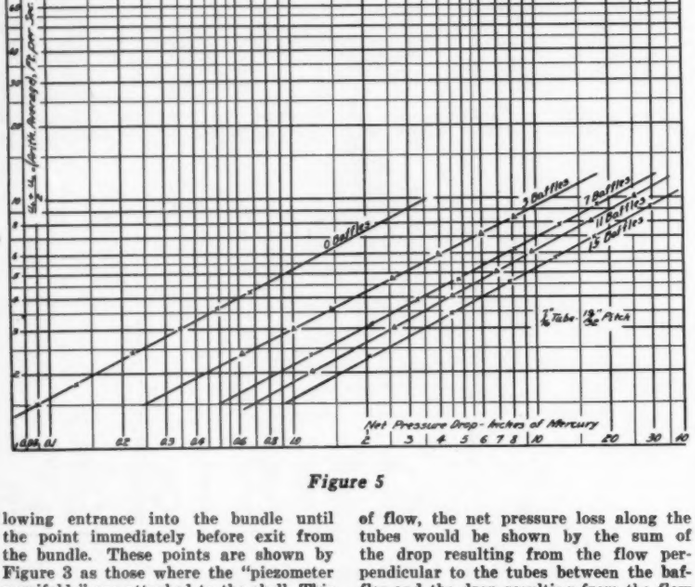

Figure 5

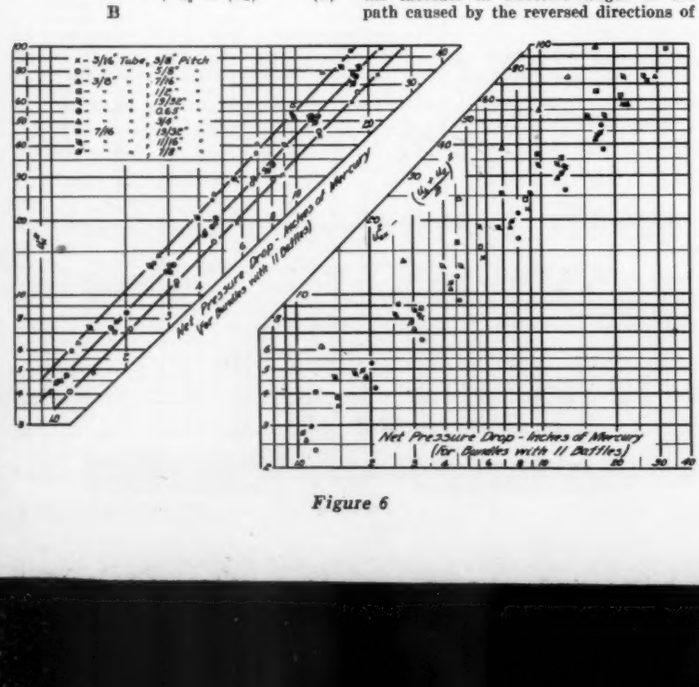

Figure 6

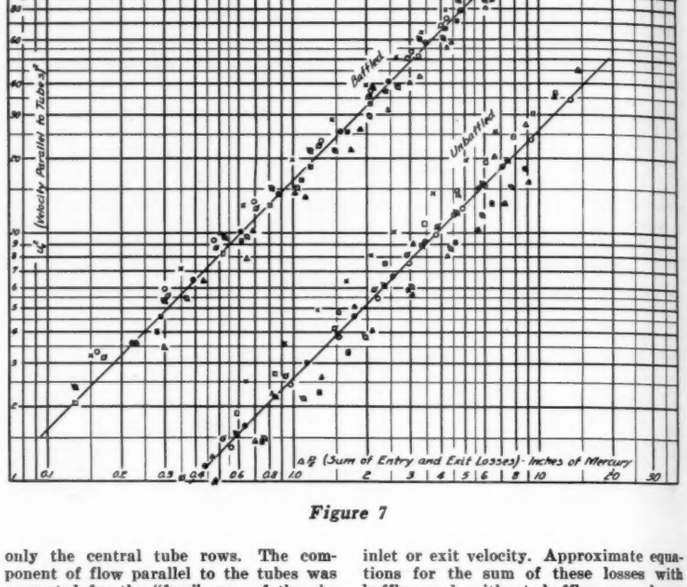

Figure 7

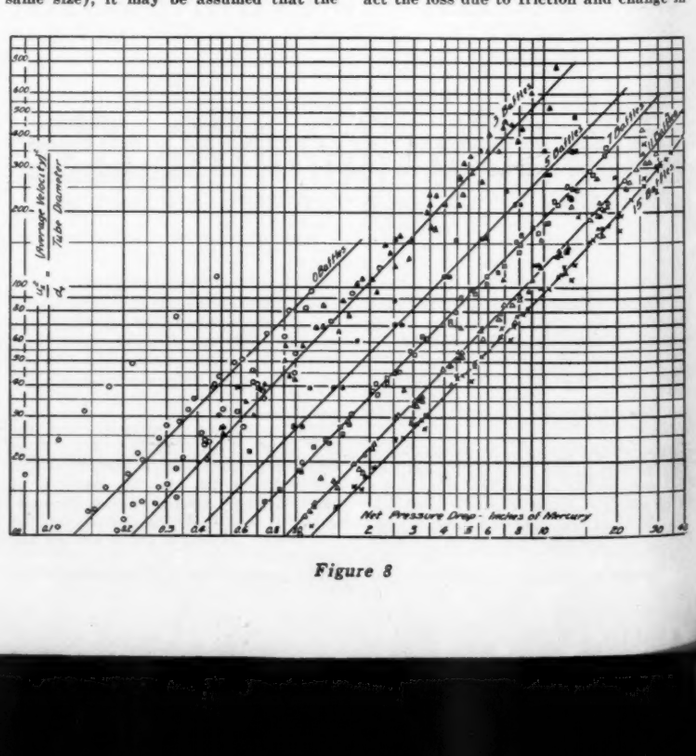

Figure 8

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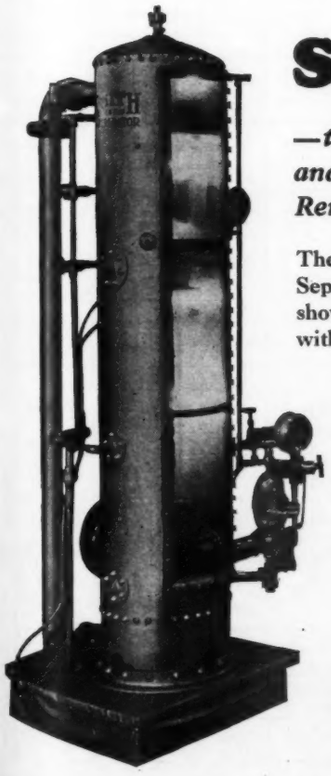

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direction. In the case of the empty shell, the friction loss at entrance was so small and the decrease in velocity was so large that the resulting pressure differential measured at this point was positive (i.e., indicated an increase in static pressure). These pressure losses are shown as a function of the velocity in the bundle parallel to the tubes by Figure 7 and by Equations 2 and 3. The ratio of the "free" area in the bundles without baffles to the "free" area in the bundles with baffles is approximately 3 so that, for the same quantity flowing, the velocity in the tube bundle (parallel to the tubes) for the unbaffled bundles is approximately one-third of that for the baffled bundles. This results in a greater change in velocity for the same velocity parallel to the tubes for the unbaffled bundle than it does for the baffled bundle and hence a greater pressure loss. Based as a function of the inlet and exit velocities, the sum of the entrance and exit losses for the baffled tube bundle is approximately 37 per cent greater than the corresponding losses for the unbaffled bundles.

Flow Equation, Diameter of Passage, and Friction Factor

In order to obtain a friction factor that could be shown as a function of the grouping of variables (modified Reynold's number), $D'u_x s/z$ (where D' = the equivalent diameter of passage, u_x = the computed average velocity, s = the specific gravity, and z = the absolute viscosity), it was necessary to determine the effect of the tube sizes, the tube spacing, and the number of baffles on the pressure drop along the tubes. It was found that by dividing the square of the "computed" average velocity by the tube diameter and plotting the pressure drop as a function of this quotient, a consistent correlation was obtained for all data from the bundles with a particular number of baffles regardless of the tube size and tube spacing. This plot is shown collectively by Figure 8 and for bundles with 3 and 15 baffles by the curves of Figure 9.

From these plots at constant ordinates (i.e., constant values of u_x^2/d_t), the drop in pressure for each baffle combination (0, 3, 5, 7, 11 and 15 baffles) was plotted as a function of the number of baffles and is shown by Figure 10. The net and total pressure losses are shown as functions of the number of baffles at constant inlet and exit velocities for different tube bundles by the graphs of Figure 11.

The plots of Figure 11 show that the pressure loss increased continually with some power of the number of baffles

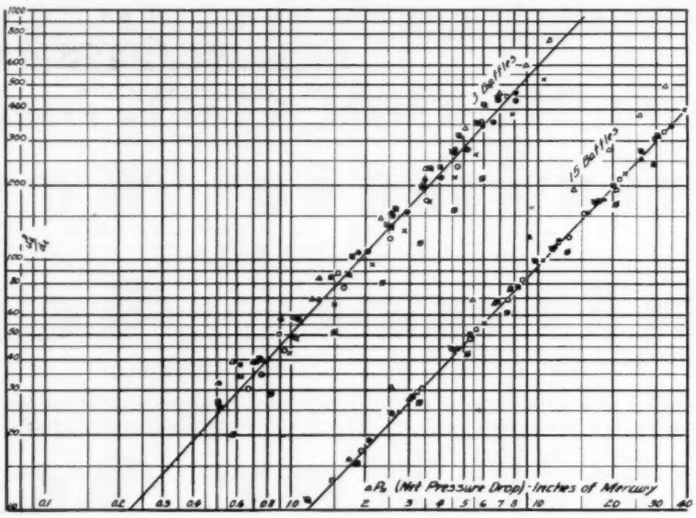

Figure 9

while, in the case of Figure 10, it is shown to increase (above the critical point) more nearly as a linear function of the number of baffles. This last relation is to be expected if Fanning's equation is accepted as applying to these fluid friction losses since the number of baffles should not affect anything more than the length of path or the velocity of flow.

This approximate linear relation between the number of baffles and the pressure losses results from the increased effect of the perpendicular component of the velocity of flow as the number of baffles are increased. The low values of fluid friction for the smaller number of baffles is largely due to the longer radius of the turn around the baffles in these cases and, hence, the smaller effect of the perpendicular component producing turbulence.

As may be noted from the curves of Figure 10, the bundle with three and five baffles show a lower drop in pressure than would be shown if a true linear relation is assumed for the upper region. In order to apply the same equation of flow to the bundle without baffles as was used for the cases with baffles, it was necessary to assume that this case (i.e., bundle without baffles) corresponded to a bundle with two baffles. In other words, according to the equations used, a true critical point exists in the region of three baffles and the minimum drop for a particular value of u_x^2/d_t is the same as for a bundle with two baffles. It may be said, then, that the fluid friction in the flow of liquid around the tubes in these bundles is affected by the size of the tubes, the number of baffles and the size of the containing vessel. The space between the tube affects the average velocity, but does not appreciably constrain the direction of flow, whereas, the containing vessel affects the direction and size of the "undirected" component of the velocity. The diameter of the tube affects the pressure loss because it controls the sharpness of the angles through which the fluid turns as well as controlling the number of individual streams of flow for a particular size shell and tube spacing. While the number of baffles affects directly the size of the passage at any one point and, hence, governs the maximum size of the stream flow.

Considering these arguments, the following equation is obtained:

$$\Delta p = \frac{f \rho L u_x^2}{24g\left(\frac{d_t D_s}{N_b}\right)} \qquad (4)$$

where:

- Δp = the drop in pressure along the tubes, lbs. per sq. in.
- ρ = the density of the liquid, lbs. per cu. ft.
- L = the length of the passage, inches, measured along the tubes.
- u_x = the average velocity, computed as shown by Equation 1, ft. per sec.
- g = the force of gravity, ft. per sec.^{2}
- d_t = the external diameter of the tube, inches.
- D_s = the inside diameter of the shell, inches, equals 4.03 for these cases.
- N_b = the number of baffles (2 for the zero baffle bundle).

By comparing this equation with Fanning's original, i.e.,

$$H = \frac{f L u^2}{24gm} = \frac{2f L u^2}{gD'} \qquad (4A)$$

it may be noted that the diameter of the passage in this case is shown by $d_t D_s/N_b$. That is, the effective diameter, D', which

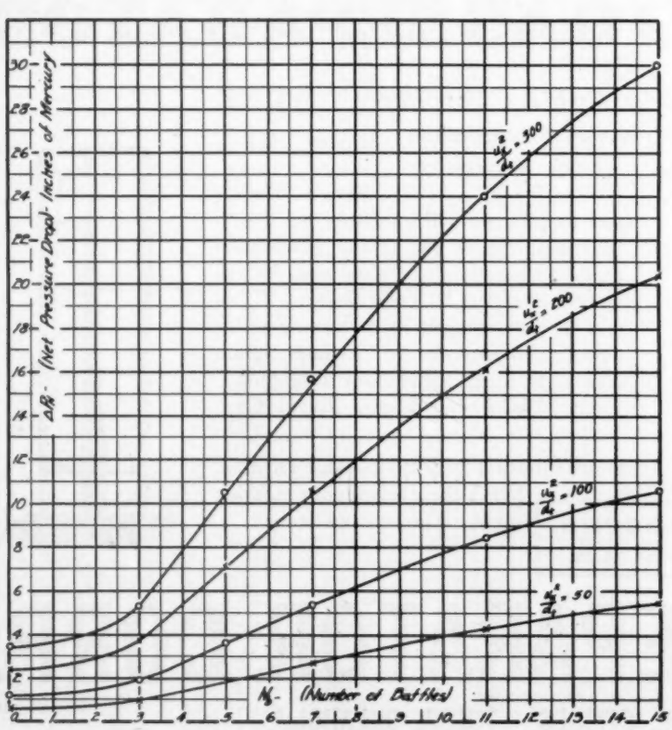

Figure 10

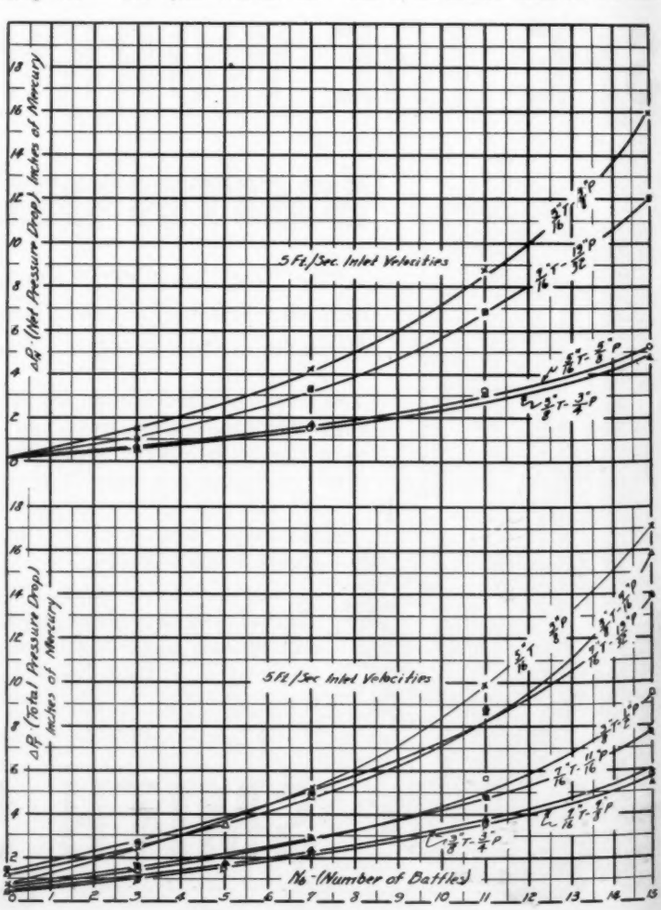
ΔP (Net Pressure Drop) Inches of Mercury
ΔP (Total Pressure Drop) Inches of Mercury
5 Ft./Sec. Inlet Velocities
Nb - (Number of Baffles)

Figure 11

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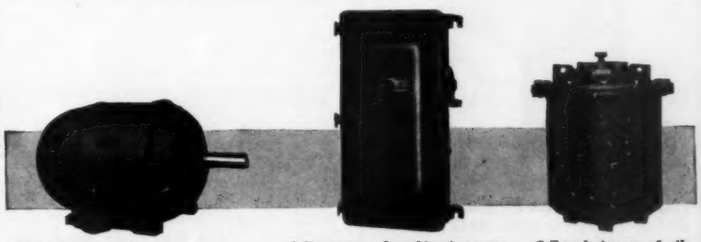

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is used in the grouping of variables, $D'u_z s/z$, shown above, is obtained by

$$D' = \frac{d_t D_s}{N_b} \qquad (5)$$

According to the Fanning equation, the relation between the hydraulic radius and the equivalent diameter is

$$M = \frac{D'}{12}$$

where M = hydraulic radius in inches.

In a preliminary report[1] on these data for the bundles without baffles, the equivalent diameter was shown as a function of the hydraulic radius, that is, as a function of the ratio of the free area to the wetted surfaces. A consistent relation can be shown by this scheme for the bundles without baffles, but it is difficult to apply to the bundles with baffles and, hence, is shown here only as a comparative reference. This diameter was shown as

$$D' = 0.3024 + 1.852M - 0.9688M^2 \qquad (6)$$

where:

D' = the equivalent diameter, inches.
M = the hydraulic radius, inches.

The friction factor was computed for all of the data of these experiments, using Equation 4, and this factor, plotted as a function of $D'u_z s/z$, is shown by the field of points of Figure 12. The friction factor computed from the same equation but using data from the average curves for each number of baffles shown by Figure 8, is shown as a function of $D'u_z s/z$ by Figure 13.

Equations 3 and 4 were applied to the pressure drop at entrance and exit and along the tubes, respectively, of a two-pass commercial heat exchanger. This exchanger has fifteen ⅝-inch tubes in each pass and the total length of flow along the tubes is 10 feet. The inside diameter of the shell in this case is 6 inches. By the use of Equation 5, the equivalent diameter was found to be 1.33 (the diameter of the shell for each pass being found as $\sqrt{(6)^2/2} = 4.24$). The total equivalent length of flow was computed as 175 inches (including a turn of 180 degrees between the two passes). And then, for each velocity given, the value of $D'u_z s/z$ was computed and the friction factor obtained from Figure 13. The velocity, u_z', in the shell immediately after entrance and just before exit is less (in this case) than u_z because a series of one-half inch bushings (around the tube bundles) increase the velocity after the region of entrance is passed. The computed end losses (Δp_e), the computed net pressure drop (Δp_n) along the tubes, the total computed pressure drop ($\Delta p_t = \Delta p_n + \Delta p_e$), and the total drop as obtained by experiment for this exchanger are shown by Table 2. These experimental data were reported in the University of Texas, Bureau of Engineering Research Bulletin No. 3,128.

[1]Master of Science thesis, by T. F. Stack.

TABLE 1—VALUES OF $N_b'A/B$ FOR DIFFERENT NUMBER OF BAFFLES

Tube diam.—	Tube pitch	A	B	N_b (number of baffles) 15	11	7	5	3
5/16	⅝	0.96	22.75	0.591	0.422	0.253	....	0.0[illegible]
	¾	1.10	22.75	0.677	0.483	0.290	....	0.097
½	7/16	0.85	22.75	0.523	0.373	0.224	0.150	0.075
	⅝	0.74	22.75	0.455	0.325	0.195	....	0.065
	19/32	1.10	22.75	0.677	0.483	0.290	....	0.097
	0.65	1.04	22.75	....	0.457	0.274	0.183	0.091
	¾	1.10	22.75	0.677	0.483	0.290	0.193	0.097
7/16	19/32	1.04	22.75	0.640	0.457	0.275	....	0.092
	11/16	1.12	22.75	0.690	0.492	0.295	....	0.099
	⅞	1.12	22.75	0.690	0.492	0.295	....	0.099

TABLE 2

Run No.—	1	2	3	4	5	6	7	8	9
u_z'	0.81	0.99	1.21	1.39	1.73	1.95	2.31	2.65	2.90
u_z	1.40	1.72	2.08	2.39	2.95	3.35	3.97	4.56	5.12
p_c	0.26	0.38	0.56	0.74	1.15	1.46	2.05	2.70	3.42
p_n	0.32	0.48	0.69	0.89	1.32	1.68	2.32	2.97	3.74
p_t	0.58	0.86	1.25	1.63	2.47	3.14	4.37	5.67	7.13
Exp.	1.10	1.50	1.85	2.28	3.11	3.70	4.85	5.82	7.45

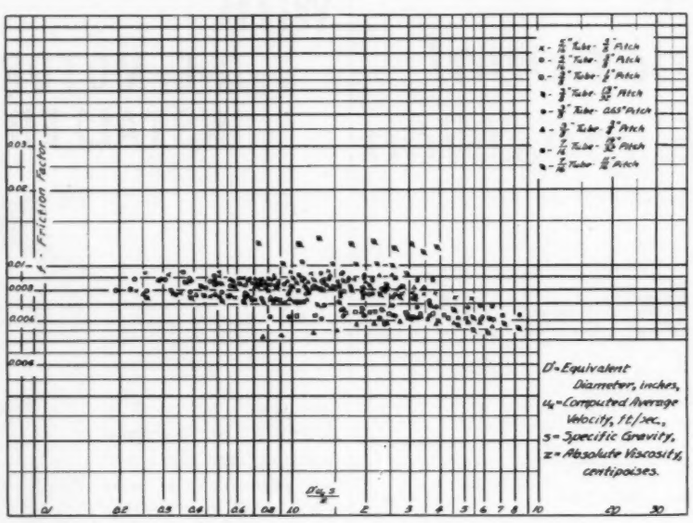

Figure 12

Conclusions

It was stated in the object of this material that these data were obtained for the purpose of establishing a relation from which the average velocity of the fluid flowing around the tubes in the shell could be obtained and to establish a relation for determining the equivalent diameter of passage.

The data presented and the resulting equations and curves indicate that such relations exist. The relations shown in this discussion are presented with simplicity and utility in mind and, therefore, may be questioned for absolute accuracy and rational development, but the plots of the friction factor show by the relative order of magnitude of these factors compared to those of the data of Stanton and Pannell's (and others) for circular pipes that the arguments and analyses are practicable.

In conclusion, then, it may be said that:

1. The diameter of the tube affects the pressure drop directly in the angle of curvature and number of individual streams for a given size shell and tube pitch.

2. The spacing of the tubes affect the drop in pressure only in the effect on the average velocity.

3. The number of baffles affect the pressure loss by changing the size of the passage and the number of turns in the path and the sharpness of the angle of these turns, as well as in the effect on the average velocity.

4. The size of the containing vessel affects directly the pressure drop in its effect upon the average velocity and the "undirected" component of flow.

5. The equivalent diameter of passage is shown, approximately, by the empirical relation,

$$D' = \frac{d_t D_s}{N_b}$$

6. The average velocity is a function of the velocity along and perpendicular to the tubes, the relative effect of each being governed by the proportion of flow perpendicular and along the tubes.

7. The entry and exit pressure losses may be expressed as a function of the velocity parallel to the tubes for a shell with the same size inlet and exit connections.

8. The net drop in pressure (drop along the tubes in the shell) may be obtained for the tube bundle with "half-moon" baffles by using Fanning's equation and the friction factor for circular pipes if the diameter and the average velocity are computed as shown above.

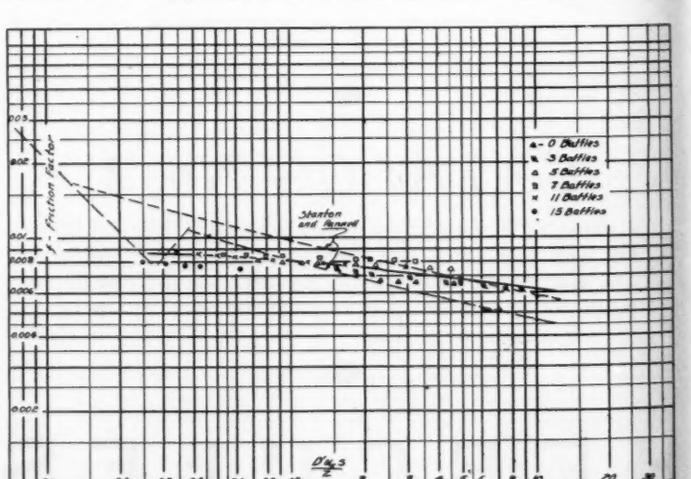

Figure 13

NEW JERSEY DIVIDEND

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THE OIL AND GAS JOURNAL

Nothing to Halt Development of Rotary Pump For Fields Occupied by Reciprocating Units

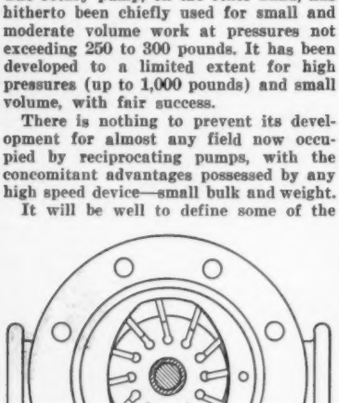
By R. J. S. PIGOTT
Gulf Research Co.*

The rotary pump, as a general type, has been commercially available for many years, but until recently has been neglected for many duties, on account of obvious failure to meet some conditions as successfully as its riyals, the reciprocating and centrifugal pumps.

The reciprocating pump has so far largely filled the field for high pressure, with small or moderate volume; and especially for viscous liquids. The centrifugal pump is supreme in large volume, low pressure pumping of low viscosity liquids. The rotary pump, on the other hand, has hitherto been chiefly used for small and moderate volume work at pressures not exceeding 250 to 300 pounds. It has been developed to a limited extent for high pressures (up to 1,000 pounds) and small volume, with fair success.

There is nothing to prevent its development for almost any field now occupied by reciprocating pumps, with the concomitant advantages possessed by any high speed device—small bulk and weight.

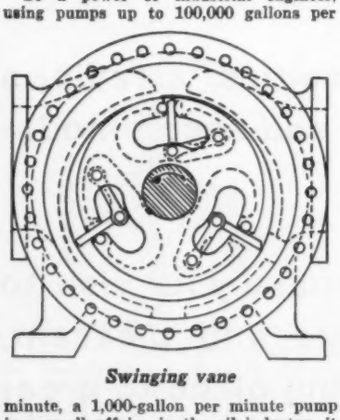
It will be well to define some of the



Guided vane

general limits. For pump analysis, up to 100 pounds per square inch may be considered low pressure, up to 300 pounds moderate pressure, above 300 pounds high pressure; 2 to 50 gallons per minute low volume, 50 to 500 gallons per minute moderate volume, above 500 gallons per minute large volume.

To a power or industrial engineer, using pumps up to 100,000 gallons per



Swinging vane

minute, a 1,000-gallon per minute pump is a small affair; in the oil industry, it is about the largest pump generally used.

It is to be remembered that the rotary pump classes as "positive displacement," like the reciprocating pump; which distinguishes it from the centrifugal pump. This difference is exactly similar to that between the steam engine and steam turbine.

*Prepared for meeting of Petroleum Division, A.S.M.E., Tulsa.

The reciprocating pump is limited to relatively low speeds, and consequently is bulky; on the other hand, low speed permits the use of packing methods for high volumetric efficiency that are inadmissible at high rubbing speeds.

The volumetric efficiency of the reciprocating pump is high, and little affected by size. Under good conditions it should be around 90 to 93 per cent. The overall efficiency should be around 80 to 85 per cent. In some large installations the overall is as high as 90 per cent, but this need not be expected in ordinary service.

The centrifugal pump is greatly affected by size and to some extent by staging. Table 1 gives the usual values:

TABLE 1

Gallons per minute	Stages	Pressure (lbs.)	Efficiency (per cent)
80,000	1	15	83
1,000	1	100	78
40	1	100	55
1,000	4	300	72
400	4	300	68

These values are only good for water. For more viscous liquids, the efficiencies are reduced, and for oils of 100 centipoises or more, become quite impractical.

To forestall objections to the above figures, the writer is fully aware of the Rannett design. This pump is a special design for conditions well suited to centrifugal pumps. Every attention was given to getting high efficiency. To extend this type of design for general use would be impracticable. Some of the figures are a little misleading. Correspondence with the designer places the efficiency at 81 to 83 per cent, depending on the head.

The advantages to be gained from a substitution of rotary pumps for reciprocating are (a) small bulk, (b) less first cost and (c) about equal efficiency.

Types of Rotary Pumps

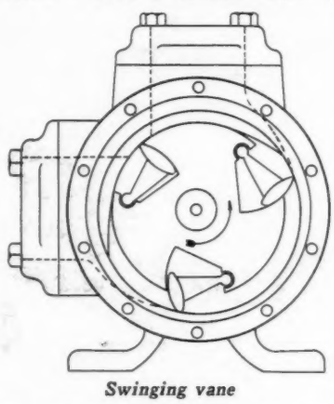
The commercial types so far exploited may be classified into five groups, as given below:

Group—	Type	Examples
1. Paddle or vane	(a) Guided vanes	Vickers, Beach Russ, Romec
	(b) Swinging vanes	Blackmer, Monarch
2. Oscillating piston, or eccentric		Kinney
3. Gear	(a) Lobular, two and three teeth	Waterous, Connersville, Quimby SBU
	(b) Special contours	Northern, Waterous
	(c) Spur gear	Tuthill, Schutte & Koerting
	(d) Helical gear	Worthington, Schutte & Koerting, Roper, Kinney, Barnes
	(e) Internal gear:	
	Two teeth diff.	Tuthill Viking, Perfection, Kraissl
	One tooth	P.L., Hill, Stothert & Pitt
4. Screw		Quimby, De Laval Imo
5. Radial piston		Hele-Shaw, Oil-Gear, Northern
6. Swash plate		Waterbury
7. Miscellaneous		Rotapiston, Mechanical Devices Co.

There are at present more examples of the 1-a, 3-c and 3-d types than any others.

The miscellaneous types include such designs as "square piston" lateral wobble-plate, and some other trick designs. None of these are extensively used, and mechanically they are so far unfit for high pressure.

Figure 1 shows the guided vane type; Figure 2 shows the swinging type; Figure 3 shows a partially guided, partially swinging vane; Figure 4 shows the oscillating piston type with single abutment; Figure 5 shows a bilobular impeller;



Swinging vane

Figure 6 shows a trilobular design; Figure 7 shows a section applying to both spur and herringbone external gears; Figure 8 shows the internal type with a difference of two teeth between pinion and ring gear; Figure 9 shows the internal type with one tooth difference, eliminating the third abutment; Figure 10 shows the screw pump in the original two-screw design; Figure 11 shows a recent three-screw pump.

The radial piston and swash plate types are only employed for hydraulic transmissions, and since they employ very closely fitted pistons, are suitable only for perfectly clean lubricating liquids. They are also quite costly.

Losses

Two principal classes of losses occur—leakage and friction, as follows:

(a) Slip or leakage past capillary seals such as vane or tooth tips in case, sliding surface.

(b) Capillary seal friction, due to liquid shear; in some cases affecting leakage by lowering the viscosity.

(c) Bearing friction.

(d) Gear or impeller rub.

(e) Stuffing box friction.

(f) Hydraulic losses, shock and friction.

The writer has definitely proved that the leakage and friction of rotary pumps may be calculated with considerable accuracy for any size, speed, pressure, and viscosity.

Leakage through capillary size sealing passages, such as close fits on normal parts, is determined by the entrance head, and conduit friction. In the viscous region of flow, occurring for most cases, leakage may be determined from

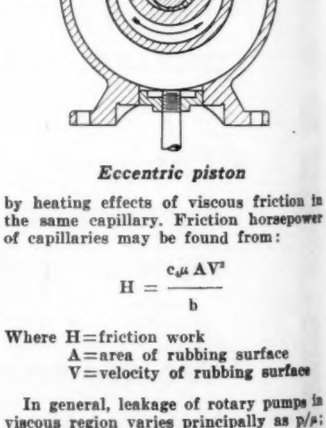
$$p = \frac{c_1 \mu l v}{b^2} + c2_2 v^2$$

In the turbulent region (chiefly for water and other thin liquids at high pressure, or large gap):

$$p = \left(\frac{c_3 f l \rho}{b} + c_2\right) v^2$$

Where p=total pressure across seal
ρ=density, lbs./cu. ft.
μ=actual mean viscosity in seal
l=length of path
v=velocity, ft./sec.
b=breadth of capillary gap

In some cases μ is not that of the main liquid pumped, but must be found from equilibrium conditions as produced



Eccentric piston

by heating effects of viscous friction in the same capillary. Friction horsepower of capillaries may be found from:

$$H = \frac{c_4 \mu A V^2}{b}$$

Where H=friction work
A=area of rubbing surface
V=velocity of rubbing surface

In general, leakage of rotary pumps in viscous region varies principally as p/μ; and for one speed and pump size, capillary friction varies only as $1/\mu$.

Tooth or vane friction varies chiefly with p/μ, modified to some extent by the character of contact.

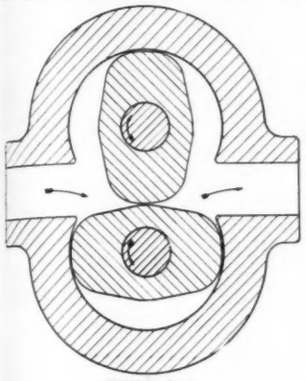
Bearing friction, for sleeve bearings, varies basically according to much the same form as for capillary surfaces, but since the dimension b is determined by the speed, viscosity and load, and viscosity varies quite widely in the bearing, the expression becomes complex. Howarth's A.S.M.E. papers give most of the data.

For ball and roller bearings, the

torque is principally dependent on load, to about the 1.4 power, and independent of speed or size, provided the bearing is substantially dry. But as most ball and roller bearings are run partially flooded, a viscous friction dependent on viscosity is added, and usually a turbulent loss between the bearing and the surrounding parts.

Stuffing box friction can be computed for the present, on a selected friction factor.

Using the above method, the writer has been able to check leakages by test within 5 per cent, and friction losses within

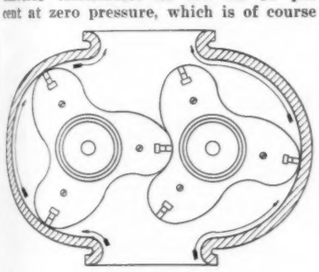


Bilobular

about 10 per cent. As a consequence, the volumetric efficiency can be predicted within about ±.75 per cent, and the overall efficiency within ±1.5 per cent. This method is very valuable in developing new designs.

Performances

The writer collected quite a little test data on various pumps, but was disappointed in some cases by the inconsistency of the tests. Some tests show volumetric efficiencies as low as 85 per cent at zero pressure, which is of course



Trilobular

impossible, unless the pump is getting air or cavitating.

Displacement has evidently been calculated incorrectly. If the displacement in these cases is recomputed on zero delivery actually attained, as 100 per cent, reasonable friction losses are obtained that do not become negative.

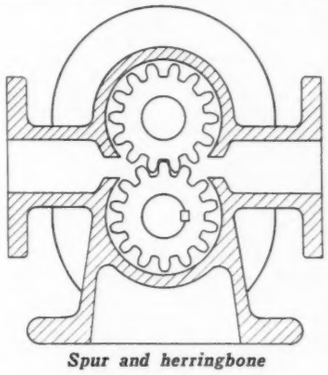
In many cases, testing on oil, the temperature was allowed to vary as much as 30° F., which changes the viscosity 250 per cent, having a very large effect both on leakage and mechanical losses. Such tests are very difficult to analyze.

The method pursued by the writer in analyzing these tests is very simple, but the principle does not seem to have been recognized by pump testers; if it were, many of the tests would not be published.

Consider a reciprocating pump, for example. The work done on the piston is the total pressure (unit pressure times area) times the distance the piston moves; this is of course the displacement. A rotary pump is exactly the same—the pump always pumps the displacement, but delivers a smaller amount because part of the displacement volume leaks back to suction side. In addition, the losses not connected with leakage, such as bearing and capillary seal friction, packing, teeth, and hydraulic friction losses, and those due to changes of direction and speed, must be included. It follows rigorously that the input horsepower is the sum of the displacement horsepower and what we may briefly call friction horsepower.

As explained above, these mechanical or hydraulic losses are all, without exception, increasing with load, which corresponds to pressure. As some of them increase at more than first power of load, the friction horsepower must be a curve concave upward, with increasing pressure. Consequently, the input curve plotted either against water horsepower output, or total pressure, cannot be concave downward, but must be at least a straight line, or more generally, concave upward. It further follows that there can never be reverse curvature.

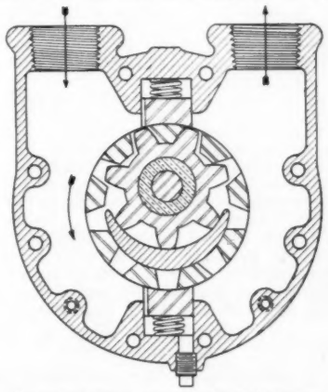
The above characteristics of the input curve are very valuable in checking the consistency of a series of tests, and the first step is to plot this line. If the curve shows a droop at the high pressure end,



Spur and herringbone

it can be due only to two conditions—either the viscosity of the fluid has been allowed to reduce, by rising temperature, or the test data are wrong.

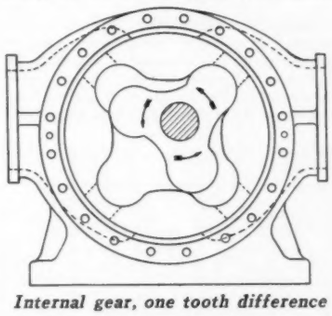
The friction horsepower can next be found simply by subtracting the displacement horsepower from the input. If the friction horsepower stays constant, or decreases with increasing pressure, we know at once something is wrong. Usually, the error is due either to a wrongly calculated displacement, or failure to note the exact speed, which has the same effect. If the displacement is calculated too large, the friction horsepower is ap-



Internal gear, two teeth difference

parently reduced. We have plenty of so-called tests on rotary pumps that show negative friction, and still the makers have not recognized this absurdity.

A similar error is often made in published tests where the volumetric efficiency is stated to be less than 100 per cent at zero pressures across the pump. Obviously, if there is no pressure difference, there can be no leakage, and therefore unless the pump is cavitating or getting air, the delivery must substantially equal the displacement at zero pressure difference. We make a point of checking calculated displacement, rotating the pump by hand to eliminate velocity heads, and maintaining constant fluid level in suction and discharge. Tests can easily be repeated to 0.1 per cent precision. The cause of the error in calculating displacement, more particularly for gear pumps, is quite evidently due to the assumption that the displacement is the volume of the whole tooth and space annulus for one gear of the pair. This assumption is only correct for tooth shapes that exactly fill the mating tooth space. For the usual involute or similar truncated teeth, the total tooth volume of both gears is only 85 to 88 per cent of the tooth annulus for one gear. To illustrate these points, consider Figure 12. The data given were gallons per minute and overall efficiency. From these, the input horsepower, water horsepower output, displacement horsepower, and volumetric efficiency can be computed. It is seen that at about 100 pounds, the "mechanical" (overall) efficiency exceeds the volumetric, which is of course impossible. The input is less than the displacement horsepower for the same range, and the friction horsepower is negative. These absurd results are probably due to using a calibrated motor, instead of a dynamometer, and the wattmeter is reading off. Figure 13 shows a similar set of data from another company, showing the same kind of errors. In this case, it is known that a calibrated motor was used. In another set of tests from the same manufacturer, the efficiency given and that computed from the gallons per minute

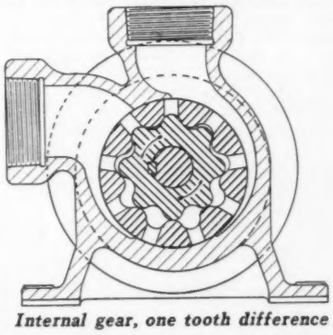


Internal gear, one tooth difference

and input (both given) do not agree by more than 10 per cent.

A manufacturer who publishes such material lays himself open to criticism either for ignorance, or suspicion of faking the data. It is curious to note that in all such material, the efficiency values given are in favor of the pump. About 30 per cent of the tests received or published show these errors (among others).

Figure 14 shows test data on a guided vane type which is probably capable of high overall efficiency. But the test data above 600 pounds is decidedly questionable, as both input and friction horsepower lines reverse curvature, which cannot actually occur. Further, the efficiency recalculated from gallons per minute and



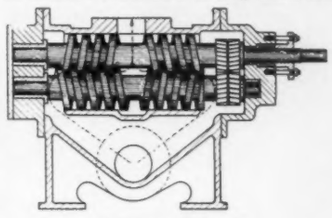
Internal gear, one tooth difference

input, does not agree with the curve given.

Aside from the above, all the other data presented appear consistent. Figure 15, oscillating piston pump; Figure 16, bilobular pump; Figure 17, trilobular pump, large size; Figure 18, special contour impeller, large size; Figure 19, herringbone gear, recent design; Figure 20, herringbone gear, older design; Figure 21, herringbone, very steep angle, almost a screw pump; Figure 22, internal gear, one tooth difference. This plot covers four sets of tests on three pumps of two designs, and shows the consistency of the tests; Figure 23, three-screw pump.

The leakage in vane type pumps is across the tips and sides of the vanes, and around the guide fit or pivot joint. All this leakage occurs when the vanes are under the two abutments. Since a vane tip cannot in any case be made to fit the bore of the housing in all positions, there is line contact and low resistance to leakage. Wear may also be serious, unless the vanes are supported against centrifugal force.

Increasing the number of vanes greatly decreases leakage; those pumps with 12 or more vanes have usually much less

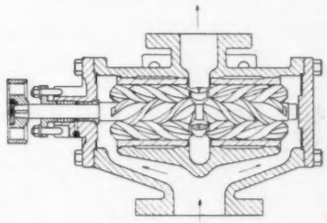


Two-screw pump

leakage than the three and four-vane types.

Leakage in the oscillating piston type is very similar, but since there is only one line-contact seal for the piston, the leakage is large and this type is entirely unsuited for high pressure.

The spur and helical external gear types are all in much the same class. Around the periphery, opposite the meshing point, the sealing is good, as many teeth are in close clearance from the case. There is also leakage across the sides of the gears, but the principal point of leakage is likely to be between the teeth at the meshing point. With the

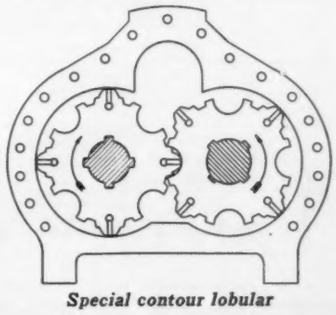


Screw pump

12 to 15 teeth, only one pair of teeth are in line-contact most of the time; with a larger number of teeth, two or more may be in simultaneous contact and the sealing is improved. Fortunately, the torque pressure assists by keeping the teeth in contact.

The bilobular and trilobular types have single line contact at the tips and meshing point only; and in addition, they are not in pressure contact, as "pilot" or "timing" gears are necessarily used.

The internal gear pumps have leakage around the periphery of the ring gears, over the tips of the gears at open mesh, and through the contact line at full mesh. In the Viking type (two teeth difference), it is difficult to get more than one tooth in contact continuously, and this is the major leakage point. In the open mesh region, the third abutment furnishes a good seal.



Special contour lobular

In the P.L. type, one tooth difference, two teeth are always in contact and the leakage at this point is greatly reduced. In the open mesh region, at least two teeth are always in series, and the sealing effect is quite good.

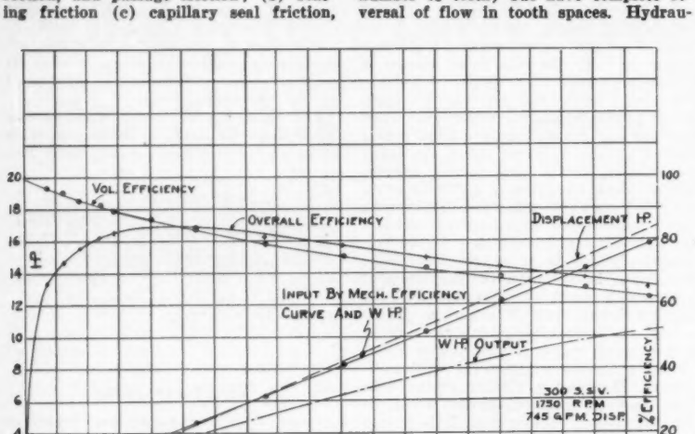
Other losses, which may conveniently be lumped as "friction horsepower" in-

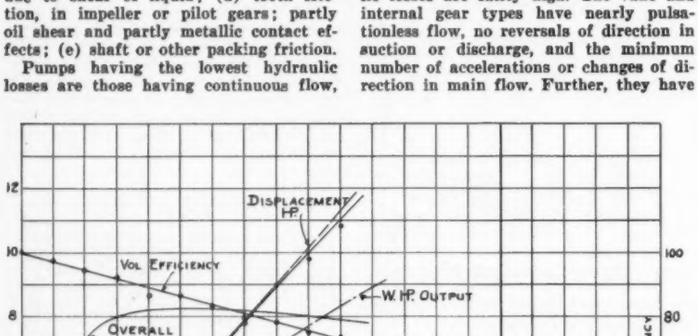
XUM

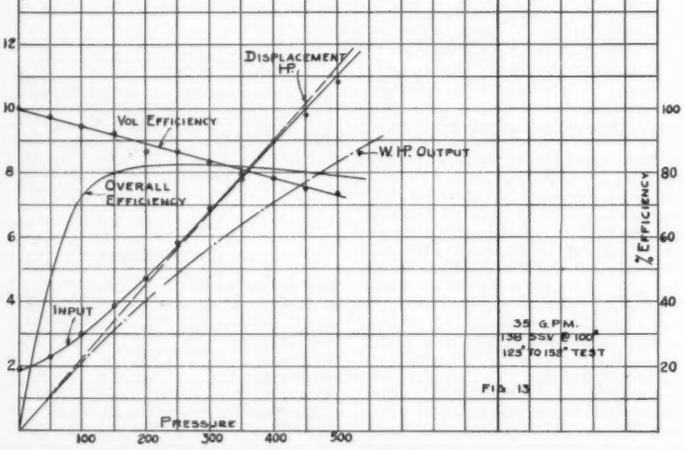
clude: (a) Hydraulic losses in the liquid, caused by accelerations, changes of direction, and passage friction; (b) bearing friction (c) capillary seal friction, due to shear of liquid; (d) tooth friction, in impeller or pilot gears; partly oil shear and partly metallic contact effects; (e) shaft or other packing friction.

Pumps having the lowest hydraulic losses are those having continuous flow, fewest reversals or turns in liquid stream, and properly proportioned passages. Inherently, the vane type and the internal gear type fulfill the requirements naturally. The oscillating piston bilobular and trilobular types have considerable pulsation. The latter two have complete reversal of flow in both suction and discharge lobe space areas.

The external gear pumps have very little pulsation (proportional inversely to number of teeth) but have complete reversal of flow in tooth spaces. Hydraulic losses are fairly high. The vane and internal gear types have nearly pulsationless flow, no reversals of direction in suction or discharge, and the minimum number of accelerations or changes of direction in main flow. Further, they have suction and discharge periods of practically one-half revolution for each. In this respect, the external gear pumps are worse; the suction and discharge periods are each limited to one-half to total arc of action of the teeth. The distance is less than 0.1 revolution, and has considerable effect on the tendency to cavitate and on the hydraulic losses.





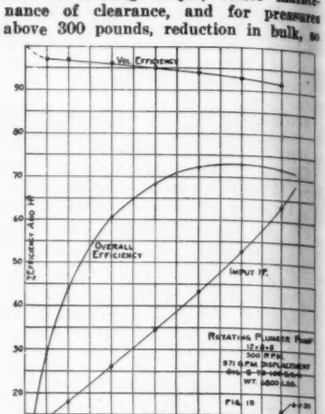


Capillary seal friction is an important part of the total losses, and varies with viscosity of liquids and speed. It can be closely calculated for any pump given the dimensions, speed and physical properties of the liquid. To illustrate, the 4x3 P.L. pump, running at 1,150 r.p.m., input 35 horsepower, total capillary seal friction is .083 horsepower at 600 pounds pressure, water (one centipoise viscosity); with 10 centipoise oil (many crudes) it is .57 horsepower, and for a lubricating oil of 100 centipoises, 3.01 horsepower.

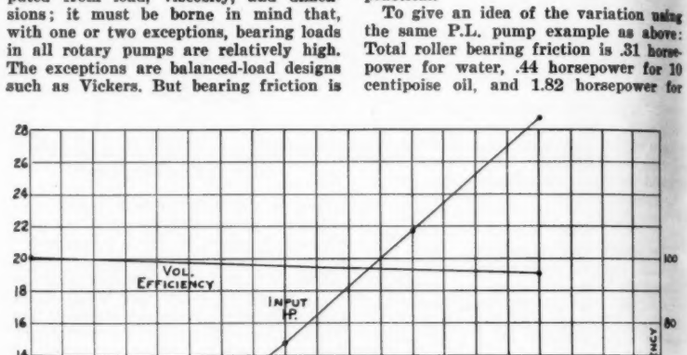
The friction from vanes, both at tips and in guides, may be considerable. Since the lobular types keep the impellers from actual contact by the timing gears, the impeller friction is nearly zero; but the timing gears more than make up for this item. In the helical and spur gear types, the loss is about the same as for similar gear drives at the same load; the load in this case being slightly under one-half the input to the pump. For the internal gear types, the friction loss is less, as the action of drive is very much smoother than any external gears. In any case, gear friction for run-in gears of good design ought not to exceed .5 per cent of input.

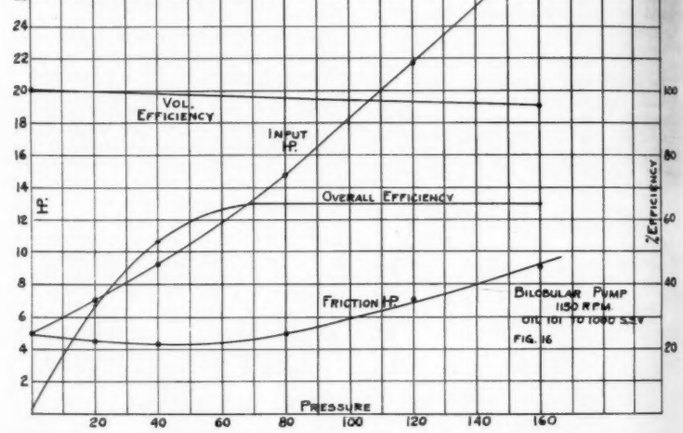
Journal bearing friction can be computed from load, viscosity, and dimensions; it must be borne in mind that, with one or two exceptions, bearing loads in all rotary pumps are relatively high. The exceptions are balanced-load designs such as Vickers. But bearing friction is by no means controlld by load only. Viscosity and speed have great importance, and some of these effects are entirely independent of load, so that balancing pumps does not wipe out bearing friction.

It may surprise some to realize that the bearing loss for ball and roller bearings partially or fully flooded with lubricant is as high as for journal bearings at high speeds, and especially at high viscosities. The advantage of the ball or roller bearing is chiefly reduction of starting torque, better maintenance of clearance, and for pressures above 300 pounds, reduction in bulk, so that the pump design is much more practical.



To give an idea of the variation using the same P.L. pump example as above: Total roller bearing friction is .31 horsepower for water, .44 horsepower for 10 centipoise oil, and 1.82 horsepower for 100 centipoises oil. For ball or roller bearings, the total loss is divided into three factors: Dry-load loss, proportional to about 1.4 power of load, independent of speed and size; viscous losses in the interior of the bearing, due to oil shear; and turbulent losses exterior to the bearing, due to fanning the lubricant around. The viscous losses may vary from almost nothing to many times the dry-load





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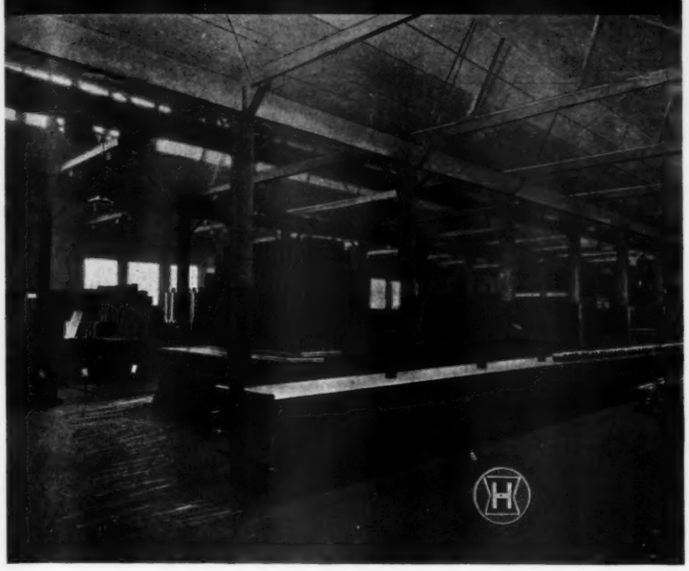

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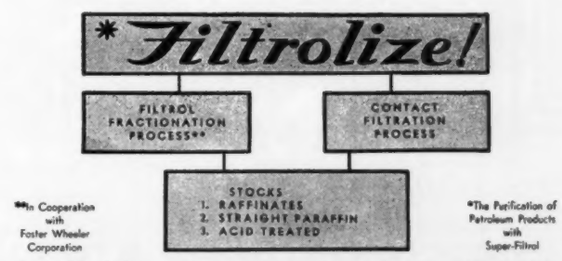

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loss, depending chiefly on viscosity and speed.

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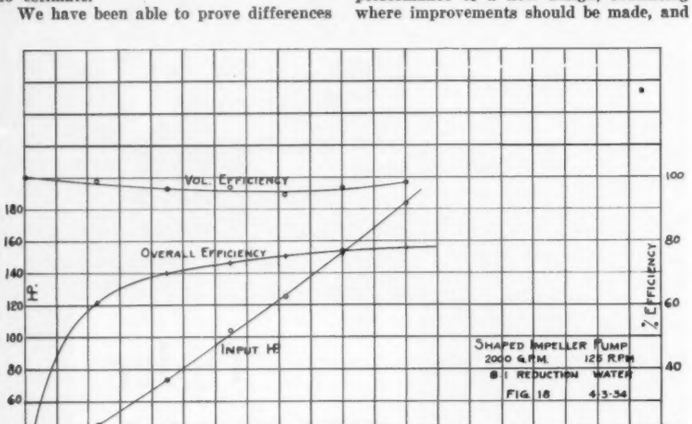


We can compute leakage, hydraulic losses and capillary friction accurately; bearing friction and gear loss fairly accurately; and packing friction much less closely. As a result, we can compute total slip within 10 per cent and total friction within 15 per cent.

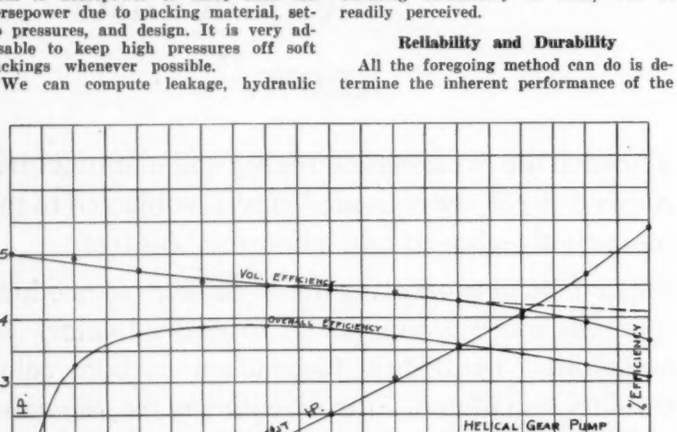


Fig. 19

Since the slip and friction losses should never exceed 15 per cent of each checking consistency of tests, will be readily perceived.

Reliability and Durability

All the foregoing method can do is determine the inherent performance of the design. When it comes to reliability and durability, we have quite another problem. The reliability and durability of bearings and ordinary involute gears can be fairly well determined; packing behavior is fairly well established for some standard designs. We know little about many new packing devices. But about the behavior of capillary seals, especially with dirt or abrasives present in the liquid, we know as yet comparatively little.

Our own experience indicates that clearances less than .001 inch per inch of diameter (ordinary bearing type fits) are about the minimum that can be used without serious and continual trouble with seizure in ordinary materials at high speed and pressure. There is a very great difference in behavior of different materials in capillary seals; we find that hardened and ground materials are so superior to cast iron and bronzes, both in eliminating seizure and raising durability, that there is not much question about their use.

Of course, for low pressures (say 150 pounds) and moderate speeds, cast iron and bronze are quite satisfactory, but the clearances must be opened up to use them.

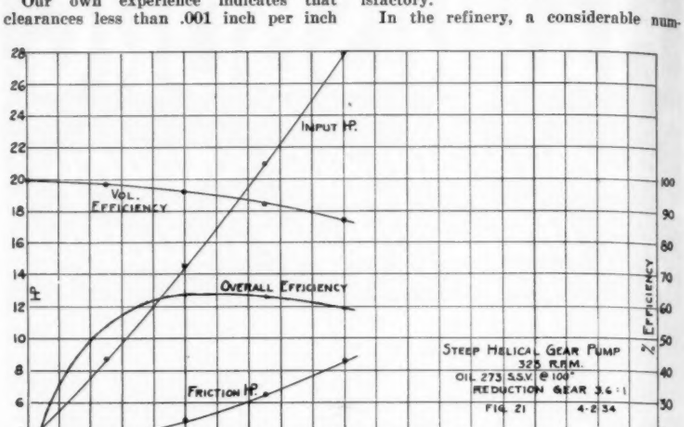
One trouble present in many designs that has greatly affected durability, is "trapping." Many pumps now on the market have definite trapping of liquid—usually between meshing teeth. This condition may give rise to very heavy pressures if the pump is tightly fitted. As long as the pump is used for low pressures, and is not too closely fitted, the trapping will not be noticeable. But the same pump, fitted close for high volumetric efficiency, at high speed and pressure, will be very noisy and ruin the bearing in a few hours.

Some of the designers are aware of this trouble, and have devised various expedients to cure it; the Schuette and Koerting, and Waterous pumps show two methods.

Use of Rotary Pumps for Oil Production and Refining

All the foregoing has merely indicated some of the possibilities and limitations of rotary pumps. There are many in use for circulating water, or transfer service on tanks, but nearly all of these are operating at low pressure, not above 100 pounds, and moderate speed. The durability record is apparently not too satisfactory.

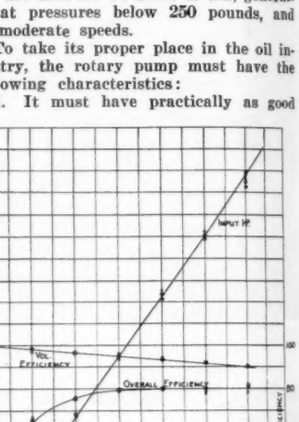
In the refinery, a considerable number are used for all kinds of oils, generally at pressures below 250 pounds, and at moderate speeds.

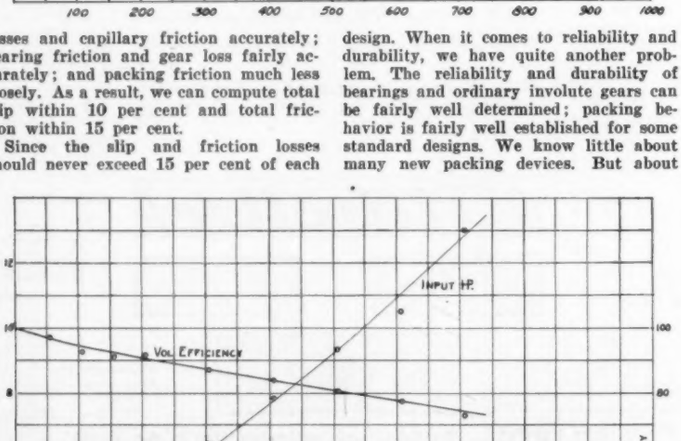


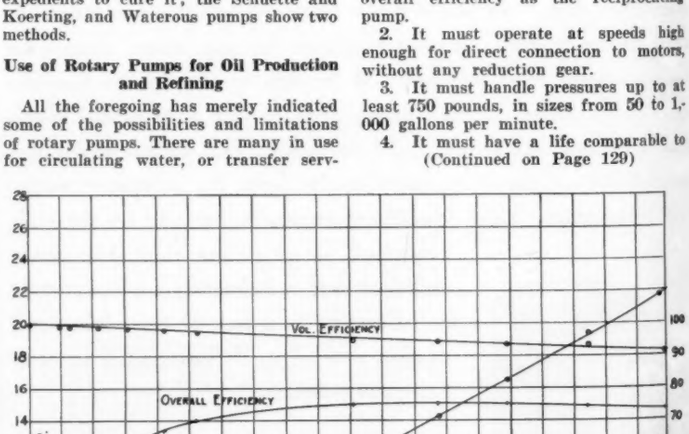
To take its proper place in the oil industry, the rotary pump must have the following characteristics:

1. It must have practically as good overall efficiency as the reciprocating pump.
2. It must operate at speeds high enough for direct connection to motors, without any reduction gear.
3. It must handle pressures up to at least 750 pounds, in sizes from 50 to 1,000 gallons per minute.
4. It must have a life comparable to

(Continued on Page 129)







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Selection of Economic Electric Motor Equipment for Pipe Line Pumping Stations; Six Schemes

By W. H. STUEVE
Oil Field Power Sales Engineer, Oklahoma Gas & Electric Co.*

Within the last 15 years centrifugal pumps have met with increasing favor among the engineers having to do with equipment purchases in the oil industry, particularly so with the pipe line and refining divisions. In the pipe line division centrifugal pumps are now on the market, having mechanical efficiencies of the order 75 to 85 per cent, when volumes of 40,000 to 50,000 bbls. per day at 800 pounds are considered, and when lower values of volume are considered, rarely will such mechanical efficiency fall below 65 to 70 per cent.

In other words, it may be said that efficiencies of centrifugal pumps are comparable with the efficiencies obtained with plunger type of pumps for similar capacities. The accepted prime mover to operate centrifugal pumps was either the electric motor or steam turbine. Within the last several years, however, a growing tendency has evidenced itself in the pipe line division to apply power to centrifugal pumps by using internal combustion engines through stepup gear speed increasors. This arrangement has met with fairly well received approval, when construction problems are presented, and one of the two principal reasons for receiving such apparent approval at this time is the inherent variable speed characteristics obtainable in the internal combustion engine, which satisfied the operators, and the other reason is that of lower initial cost of gear box plus centrifugal pumps as against the higher priced conventional plunger pumps, which satisfied the investor or banker.

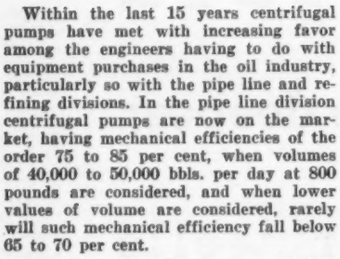


Figure 1—Relative power requirements of motors and engines

The purpose of this discussion will, therefore, be to analyze the several methods of accomplishing speed variation and control of the electric motor, and its economic value, when compared to the engine geared to centrifugal pump. The basic hypothesis being, first, that the general overall use of engines geared to centrifugal pumps is acceptable to most pipe line designers, second, that engine speeds can be reduced from maximum rated speed to within 60 or 70 per cent of such rated speed without sacrificing much in the way of thermal efficiency, third, that volumetric deliveries of pipe lines are subject to change without much notice and are subject to wide variations in capacity.

Use of Electric Motor

The electric motor has been selected in this discussion for comparison because of its widespread acceptance in quite a few cases by the pipe line designers, rather than complicating this discussion by considering steam turbines also, since boiler makeup and condensing water and their attendant problems are usually too intricate and unsolvable to be seriously considered in most cases.

In practically all the electric motor installations made, it has been the practice to use constant speed induction motors, commonly known as squirrel cage type, the designers having in mind the higher mechanical efficiencies obtainable with higher speed pumps, the motor speed most considered being 3,600 r.p.m. synchronous, which permits the actual motor speed under load to be approximately 3,550 r.p.m.

The centrifugal pump has operating characteristics which permit the mechanical efficiency to remain almost constant for speed reductions down to about 70 per cent of maximum rate speed. The pipe line characteristics follow closely those characteristics also, in that the initial pressure required for decreased volumes fall off as the square of such volume. The horsepower therefore being a function of volume and pressure will vary as the cube or third power of speed or volume. Now to convert the flexible speed characteristics of the internal combustion engine into power input savings when compared to the constant speed induction motor, the curves are shown in Figure 1 with percentage of power required as ordinate, and percentage of maximum capacity as abscissa.

With two pump units, each of which will deliver total volume at one-half total pressure, the operator of constant speed electric pumps is forced to three methods of making his deliveries, first, with throttled head gate, as shown by line "AX," second, with head gate wide open at maximum rate of delivery for fewer hours per day, as shown by line "AY," and third, at maximum rate for a given number of hours per day and finish out daily deliveries at minimum rate using one-half pump unit during the daily period, as shown by line "AD."

From Figure 1 note that the power requirements of the engine, curve "AE," are always lower than the constant speed electric operation under most ideal theoretic operating conditions, spoken of above as the third operating choice. The most likely choice of above operating methods would be the first, or to operate with throttled header gate for decreased capacities, for the second choice is eliminated because the flow of oil through the line ordinarily cannot be stopped in cold weather, or that operators do not care to shut down entirely, and the third choice may be eliminated due to poor electric load factor obtainable since most power utilities rates are predicated on load factor. It is true that less energy may be consumed in this manner but the net rate earned during the billing month would be higher and tend to overcome any saving made in energy used, and also pipe line dispatchers are reluctant to be constantly changing or shifting use of pumps so many times daily.

Electric Power Rate

Thus, if a power rate was offered to the pipe line company which would be competitive with engines at 100 per cent capacity or 100 per cent electric load factor after all factors of fixed charges, labor, fuel, and maintenance were taken into account, the power rate would have to be either a flat rate of the value at 100 per cent load factor back to 50 per cent load factor, or in fact a gradually decreasing rate, instead of the customary gradually increasing net rate as quoted by power companies, in order to be competitive with variable speed engines. This is brought about due to the increased energy required to be purchased, using constant speed motors, at volume deliveries of less than 100 per cent capacity as against the actual energy an engine is called upon to produce for similar or like volumes.

Thus, with present accepted electrical equipment, that is the constant speed induction motor for pipe line service, the pipe line is justified in asking for a flat power rate for all load factors from 100 per cent down to about 50 per cent; yet on the other hand, the power utility cannot offer such a rate, since they, being regulated by commissions, must sell their wares to all alike, and customers who require "electric power" for their operations instead of "mechanical power" application, can pay a higher energy rate at load factors less than 100 per cent. Therefore, we now reach an impasse, and the logical solution of the difficulty may be for the electrical industry to look about for equipment that can meet the pipe line requirements in the way of speed control or its equivalent. Enumerated below are the several suggested methods of meeting this problem.

Method of Securing Speed Variation

1. Use of alternating current variable speed motor, obtaining speed control by varying rotor resistance, commonly known as slip ring motor.

2. Use of direct current motor as prime mover providing conversion from alternating current supply with rotary convertor.

3. Use of direct current motor as prime mover providing conversion from alternating current supply with mercury arc rectifier.

4. Use of variable speed alternating current motor 900 r.p.m., with rocker brush and commutator for speed control, geared through one to four-speed increasors to centrifugal pumps.

5. Use of constant speed alternating current motors with isolated alternating current power generators driven with variable speed engines, and speed variations being secured by frequency change.

6. Use of a great number of constant speed alternating current induction motors each driving pumps which would be fitted to head capacity conditions, say for 95, 90, 85, 80 or 75 per cent capacities.

It is generally recognized that if speed control of electric motors and consequent volume control could be obtained from 100 per cent down to about 75 per cent that the problem would be solved as to making the electric station with variable speed engines.

Any one of the above mentioned six methods of securing speed variation would increase the first cost of an electric motor driven pump station, yet the benefits derived in the way of decreased purchase of power may be overcome by the fixed charges on such increment of investment increase. Factors, of course, to be taken into account first, would be the acceptance of any or all the proposed schemes by the pipe line engineer. Before going into the feasibility or practicability of the proposed schemes to secure speed control, it might be well to look at first cost and overall efficiencies obtainable from the various methods, in order to eliminate as many schemes as possible before going into their possible acceptance by pipe lines with regard to working practicability and possible hazards.

Thus, by making comparison of the six schemes with the now standard accepted method of making station installations and using such present station as a base, the following table can be prepared to show the relation between first cost and operating efficiencies:

TABLE 1—ELECTRIC PUMP STATION OF 600 HORSEPOWER INSTALLED PRIME MOVERS

	Relative first cost	Overall operating efficiencies at following capacities			
		100%	90%	80%	75%
Typical present station	1.0	70.5	69.4	67.2	65.5
Scheme No. 1	1.15	68.0	60.5	54.0	49.0
Scheme No. 2	1.48	63.0	61.8	59.7	57.0
Scheme No. 3	1.57	65.0	63.5	61.3	60.0
Scheme No. 4	1.30	70.5	70.5	70.5	70.0
Scheme No. 5	2.50	....	....	....	....
Scheme No. 6	1.8	70.5	70.5	70.5	70.5

From the above Table 1 it is noted that only Scheme No. 1 and Scheme No. 4 are within the scope of reasonable first cost and constant efficiencies.

The balance of Schemes Nos. 2 and 3 using direct current motors and conversion equipment seem to require too much investment and overall efficiencies are too low for consideration. Scheme No. 5, that of generating alternating current and obtaining speed control by varying the alternating current frequency, is also too expensive for consideration as is the case with Scheme No. 6.

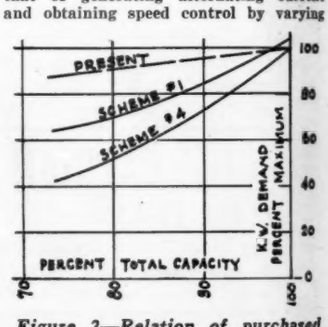


Figure 2—Relation of purchased energy requirements of present practice using constant speed motors to energy required using variable speed motors

The curves shown in Figure 2 indicate hourly energy required at various capacities, and the advantage of Scheme No. 4 over that of any other submitted herewith. It is true the investment is approximately 30 per cent greater than the present accepted practice of using alternating current, constant speed motors, but note that the energy savings are from 25 to 50 per cent, which increased investment would easily pay for itself in from one to two years' operations at a fair capacity factor.

Conclusion

This development therefore, by a process of elimination, indicates that the use of a brush type alternating current variable speed motor of about 750 to 900 r.p.m. maximum, geared to a centrifugal pump through one to four or five-speed increasor would tend to overcome the present objections to constant speed motors, and at the same time justify the power utilities gradually increasing rates for poorer load factors.

The problem confronting the electrical industry then would be to gain approval

*To be presented at a meeting of the American Society of Mechanical Engineers at Tulsa, May 16.

of the pipe line designer to accept the commutating type motor, shown as Scheme No. 4 in this discussion.

Fire walls can be installed between the motor and pump room at a reasonable cost to eliminate any fire hazard, which cost is included in Table 1 under the caption "Relative First Cost." Large refineries are using this type of motor for hot oil charging pumps where the hazard is no doubt greater than would obtain in a line pump station.

While the use of Scheme No. 4 appears probably the most economical, it must not be construed that Scheme No. 1, using "slip ring" variable speed motors, should be entirely eliminated from consideration. The lower relative first cost of Scheme No. 1, coupled with a supposition that volume control from 100 to 85 per cent would be sufficient and satisfactory to pipe line operators, would tend to then justify consideration of the slip ring motor. The slip ring motor can be made totally enclosed, and if a fire wall is installed, such hazard would be entirely eliminated.

BUYS OHIO LEASES

CYGNET, Ohio, May 5.—Carl H. Schwyn, president of the Cygnet Savings Bank, recently purchased 375 oil leases containing 3,546 producing wells from the Ohio Oil Co. Crude produced in Sandusky, Seneca, Wood, Lucas and Ottawa Counties will be sold by Mr. Schwyn to the National Refining Co. and Ohio Oil Co. Some of the leases are 40 to 45 years old.

Mr. Schwyn has been in the oil producing business for 16 years, coming to Cygnet from Toledo where he was vice president of the Home Bank. He was engaged in the producing business for nine years with the late Rolla Hughes in Wood County.

Nothing Need Prevent Rotary Pump Development

(Continued from Page 126)

those of centrifugal or reciprocating pumps on the same duty.

5. Cost must be less than reciprocating pumps.

Our survey of the present field shows plenty of small pumps available for pressures up to 2,500 pounds, and direct motor drive; but no large pumps.

Most of these pumps are used in machine tool operations, such as presses, carriage feeds, broaching, etc. So far as we can learn, the durability is as yet far from satisfactory, and we are quite sure that many of the efficiencies claimed are not actually attained.

One or two of the designs look like good possibilities for development in larger sizes. Our own development, we know, will meet these requirements, because it was developed specifically to do so, and enough field experience has been obtained to show high durability, so that at least one design is definitely fit for the work, and we have little doubt others can be developed.

The advantages from the use of rotary pumps at full motor speeds in place of reciprocating pumps are: (a) Greatly reduced space requirements; (b) smaller repair parts to handle; (c) smooth delivery, little pulsation; (d) ability to handle suction lift or vacuum.

It appears improbable that the rotary pump should replace the centrifugal pumps for water or low viscosity liquid handling except where the pump must be self-priming. For this reason, only rotary pumps are now used for electric gasoline-dispensing pumps, and bulk station work.

For many years, the rotary pump has been rather a stepchild in the field; but our own development, and perhaps others, is likely to prove very shortly that the rotary pump can replace the reciprocating pump successfully, much as the steam turbine wiped out the reciprocating steam engine 25 years ago for power service.

MOVE SINCLAIR OFFICES

Chicago offices of Sinclair Refining Co. are being moved to the newly completed Field Building, which makes this company one of the first oil companies in the building. This building is noted for its modern and high class conveniences and appointments, having been the only large office structure built in Chicago in the last several years. It is located at LaSalle, Adams and Clark Streets, in the downtown business and financial district.

WOMEN SHAREHOLDERS MEET

CALGARY, Alberta, May 5.—The women shareholders of the Turner Valley Oil and Gas Association at their annual meeting recently elected the following officers: President, Mrs. P. D. McAtee; first vice president, Mrs. M. Morrish; second vice president, Mrs. E Horpes; secretary, Mrs. C. Chambers; treasurer, Mrs. A. Garrad. The organization aims to safeguard the interests of shareholders in Turner Valley oil companies.

LOOT TEXACO STATION

A dispatch from Nanking, China to the New York Times says: Liu Kweitang's rebel force occupied and looted the premises of the Texas Petroleum Co. at Yunho, in Kansu Province at the junction of the Grand Canal and the Lunghai Railway.

Ex-Governor Sterling Has Third Discovery

HOUSTON, Tex., May 5.—Former Gov. Ross S. Sterling has announced his third new oil sand discovery within a year. A new deep production in his No. 2 Hogg Brothers' Farm gave the old West Columbia Field at Brazoria County hopes for a new boom. The 700-bbl. well was brought in at 5,200 feet, 2,200 feet lower than the old sand which made the field the third largest in the State.

The shallow wells at around 3,000 feet, discovered in 1917, produced 74,393,000 bbls. during their flush years, placing the West Columbia just under Spindletop and Humble.

Mr. Sterling organized the Miramar Corp. early last year in an effort to recoup his oil fortune. Last June he brought in the Miramar's Phoenix Development Co. No. 1 Hull in Liberty County. Miramar now has nine flush producers at Hull. Several weeks ago he brought in a well at Goose Creek, Miramar's No. 1 Hughes, at 4,500 feet, a hitherto untouched sand.

Asked if he had struck a new sand, Mr. Sterling said: "Well, I hate to claim credit for discovering anything that's been down there as long as that oil has, but I guess we are the first to go down there and get it."

CONTINENTAL OIL INCOME

Continental Oil Co. and subsidiaries report for the first quarter net income of $1,211,483 after charges, interest and minority interest, equal to 25 cents a share on the 4,738,593 shares outstanding, compared with net loss of $2,825,247 in the first three months of last year.

Production Superintendents and Engineers of Phillips Petroleum Company

Front row: R. F. Schooling, branch purchasing agent, Oklahoma City; Stanley I. Betzer, district engineer northern Oklahoma, Burbank; Ralph Clark, division engineer, southern division, Breckenridge, Tex.; G. M. Shanor, analytical engineer, Bartlesville; C. J. Martin, superintendent automotive transportation, Bartlesville; and W. C. Cook, district foreman, Borger, Tex. Second row: L. B. Holland, southern division superintendent (Arkansas and all Texas, except Panhandle), Breckenridge, Tex.; A. R. O'Brien, district foreman, Vernon, Tex.; C. E. Klein, northern division superintendent (Kansas and northern Oklahoma), Wichita, Kans.; C. P. Dimit, vice president in charge producing division, Bartlesville; D. R. Knowlton, chief engineer and assistant to vice president, Bartlesville; H. L. McQuiston, central division superintendent (Seminole, Oklahoma City, Panhandle of Texas), Oklahoma City, Okla.; L. E. Fitzjarrald, office manager, Bartlesville; and R. E. Jolly, district foreman, northern Oklahoma, Burbank. Third row: C. E. Byron, chief clerk, automotive transportation, Bartlesville; C. M. Oden, division foreman, Smackover, Ark.; C. A. Daniels, division foreman, Panhandle, Texas; L. J. Pratt, district foreman, Seminole; G. J. Turner, district foreman, Pampa, Tex.; Earl Griffin, district foreman, eastern Kansas, Madison; Frank Berry, district foreman, North Central and West Texas, Breckenridge; T. J. Hamilton, district foreman, western Kansas, McPherson; J. P. Stephens, division foreman, Oklahoma City; M. L. Atkinson, district engineer, Seminole; C. M. Rader, district engineer, Oklahoma City; Dean Gunby, proration engineer, Bartlesville; Paul J. Hubbell, industrial relations department. Back row: J. S. Montgomery, chief clerk, engineering division, Bartlesville; W. M. Sawtelle, service car driver, Bartlesville; R. L. Wright, division engineer, northern division, Wichita; H. L. Baldwin, repressure engineer, Bartlesville; Austin Allen, mechanical engineer, Bartlesville; Harry Boxell, chief clerk, Bartlesville office; W. J. Crites, assistant chief engineer, Bartlesville; P. E. Loye, superintendent electrical equipment, Bartlesville; W. B. Lerch, chemical engineer; and H. E. Rodgers, division engineer, Panhandle.

BAKER TOOLS ARE USED

As long ago as 1907, R. C. Baker, an experienced oil operator and contractor, invented the Baker Casing Shoe which proved an immediate and lasting success. He next utilized his knowledge and inventive genius in the development of other safe and efficient equipment, particularly cementing devices. The Baker Cement Retainer and Baker Sure Shot Cement Plug were introduced in 1913; the Baker Cement Dump Bailer in 1918; and the Baker Line of cast iron cementing equipment in 1923; all of which have been improved year by year, and are recognized as outstanding tools today.

THE BAKER WALL SCRAPER

The universal demand for a safe underreamer with a wide expansion is responsible for the Baker Wall Scraper—No. 10 below. Selected steels are used throughout, and the strong, heat-treated blades will not distort in operation. When the desired depth is reached and circulation is commenced, the blades are expanded by hydraulic pressure from an enclosed piston, and cut their way out into the formation to an amazing reaming expansion; for example, the No. 6 Wall Scraper runs in easily through 9⅝" casing, and then reams progressively to a 19" maximum diameter. When sufficient reaming has been accomplished and circulation is stopped, the blades normally are closed downward into the body by a strong spring. If, however, any metal fragment from a previous fishing job (or from any other cause) prevents the blade from entering the body, a powerful shearing action results when the top of the blade contacts the casing shoe as the Wall Scraper enters the casing. By actual test, a one-inch steel bolt has been cleanly cut through under similar conditions.

UNIVERSALLY ACCEPTED

Good news travels fast, and the Baker Wall Scraper is being adopted rapidly by operators who learn of its remarkable capacity and safety; its success in scraping the face of producing sands; its ability to cut a wide shoulder preliminary to straightening an off-vertical hole; and its amazing reaming capacity for cutting large cavities for setting casing, or for securing successful cementing jobs. Performance records by major operators, descriptions and illustrations are included in a complete bulletin which we should be glad to send you upon request.

BAKWIK DRILL PIPE FLOAT

The advantages of equipping drill pipe with a suitable back-pressure valve are today recognized by the majority of experienced operators. The derrick and operating equipment is relieved of excessive weight—unnecessary wear on brake bands and wire lines is eliminated—accidents due to a parted drilling string are either minimized or prevented. However, until the introduction of the Bakwik Drill Pipe Foat, no float answered the demand for a safe, positive, acting tool from which the valve assembly could be quickly and easily removed, and just as conveniently replaced. Illustration (8) below.

MODERN CEMENTING EQUIPMENT INTRODUCED

In 1927, Baker developed and made practical Guiding, Floating and Cementing Equipment using only concrete and other non-metallic materials for the internal construction. Year by year Baker Cement Equipment has been improved until today each product presents the best possible combination of those three essentials for the safe and proper landing and cementing of casing strings—STRENGTH (equal to or beyond the collapsing strength of your casing)—VALVE EFFICIENCY (perfect leakproof sealing against the highest or lowest pressures)—DRILLABILITY (complete and rapid disintegration and circulation out of the hole).

HERE ARE THE MOST USED PRODUCTS

The units of Baker Cement Equipment principally used in all oil fields, are illustrated below, and briefly described as follows: (1) Baker Cement Float Shoe, for Guiding, Floating and Cementing strings of casing. All Baker Cement Equipment consists of a seamless steel shoe or coupling, in which a special-formula concrete plug is securely anchored. When a valve is used it is made of Bakelite, with a solid Bakelite ball which floats in ordinary rotary mud or cement. When a string of casing is being lowered in the well, this ball seats against a recessed rubber ring and provides a leak-proof seal against either low or high pressures. After the casing is in place, this ball permits the cement to pass by, and when all the cement is in place, the ball again seals against

You should have for ready reference complete details and prices on all Baker Products. May we send you the large, loose-leaf Baker Catalog? Free upon request, to any oil man

IF IT'S MARKED "BAKER"...

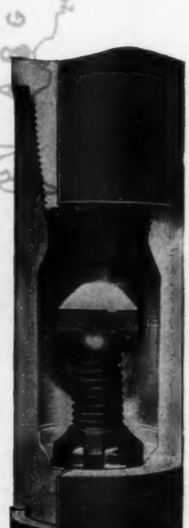
1—Cement Float Shoe

2—Cement Float Collar

5—Baker Rotary Core Barrel

6—Baker Cement Retainer

7—Whirler Collar with Basket



8—Bakwik Drill Pipe Float

NRA

BAKER OIL

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WHEREVER OIL IS FOUND

the valve seat until the cement has set properly. The internal concrete and Bakelite are then easily drilled out with the drilling bit, and the fragments come out of the hole with the rotary mud. It is then possible to proceed with drilling or coring, without danger or delay, as no metal is left in the hole. (2) Baker Cement Float Collars are used a joint or two above the end of the casing string, when the operator desires to keep the cement tailings inside the casing. Valve operation is the same as in the Float Shoe. (3) Baker Cement Guide Shoes are used on the end of the casing when a Float Collar is used. (9) Baker Cement Baffle Collars are made either in a solid type for special cementing jobs; or with a hole through the concrete to permit the passage of cement, but to stop the cementing plug one or two joints from bottom. (7) Baker Whirler Cementing Collars are very efficient for cementing a combination string, or for cementing off at any desired depth, without using valves or plugs made of metal. Made in a plain type, or equipped with a canvas basket (as illustrated) which catches any cement or cavings. (4) Baker Cement Whirler Shoe will guide and float in a heavy string of casing, and then insure a successful cementing job. Even if set on bottom ,the baffled side openings direct the cement upward with a whirling motion which does not channel into the formation.

THE BAKER WAY TO PERFECT CORES

Going hand-in-hand with the manufacture of cementing equipment which would drill up and leave no metal fragments to prevent immediate coring, it was only natural that Baker should become interested in developing modern equipment for taking better cores. Two Baker Core Barrels resulted—one for Cable Tools (No. 11 below), and one for Rotary Drilling (No. 5 to the left), which are safe and fast in operation and secure perfect cores in almost every formation. In both types the inner, or core-retaining tube remains stationary while the outer barrel cuts a core which is an accurate cross-section of the strata being penetrated. The stationary tube design in the Rotary Type cannot burn, distort or contaminate cores taken from the hardest formations.

THREADS ARE ELIMINATED

All threads have been eliminated from the Bakwik Valve Assembly (see illustration 8) which is merely dropped into position on a strong shoulder, securely held by the tool joint pin screwed down on the rubber sealing ring, and is then ready for successful operation. It is not thereafter necessary to remove the float body from the drilling string. When measurements are to be taken, the entire valve assembly is lifted out by hand, and the possibility of errors due to changing the length of the string is eliminated.

BAKER CEMENT RETAINER

Many interesting and profitable uses are found for the Model "C" Cement Retainer, originally developed for cementing under pressure. Illustration (6) shows the sturdy packing element which seals off to prevent the entry of cement between the tubing and casing when cement is pumped through perforations in the casing. It is ideal for re-cementing a water string; for packing off gas, and for various other uses soon discovered by the resourceful operator. The new Baker Circulation Jar is a valuable adjunct to the Model C Cement Retainer and always should be used. On special orders, the Baker Cement Retainer is constructed to serve as a positive Casing Bridge Plug.

OTHER BAKER PRODUCTS

There are many other Baker Oil Tools, not illustrated here, but described in detail in the large Baker Catalog—sent free for the asking—and including: Baker Sure Shot Cement Plug, which enables cable tool operators to accomplish successful cementing without calling in the cementing crew; Baker Cement Dump Bailers—the Regular Type, and a new Bottom and Top Joint of Alloy steel—both of which rapidly and efficiently carry maximum loads of cement and dump only when bottom is reached; Baker Cleanout Bailer—with various types of shoes for cleaning out in any formation encountered; Baker Pattern Casing Shoes—the Genuine—with teeth which stay sharp all the way down the hole; Baker Hydraulic Expansion Wall Hooks—which safely arrange difficult "fish" for easy removal; Baker Yungling Spiral Guide—an invaluable tool for straightening up parted pipe for recovery with fishing tools.

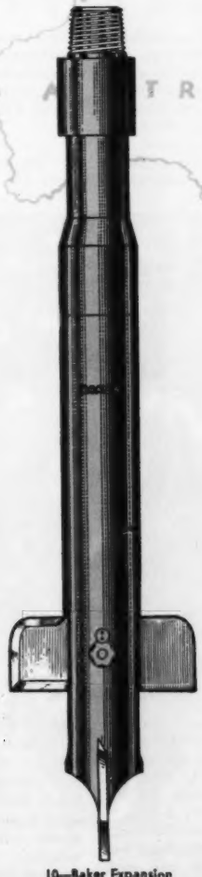
Do you find described here some Baker Oil Tools which might solve your problem? Write us giving complete information, and we will gladly furnish our recommendations.

IT'S THE BEST YOU CAN BUY!

3—Cement Guide Shoe

4—Cement Whirler Collar

9—Baker Cement Baffle Collar


10—Baker Expansion Wall Scraper

11—Cable Tool Core Barrel

TOOLS, INC. SEE OUR DESCRIPTIONS IN THE COMPOSITE CATALOG

Park, California, U. S. A.

TULSA • OKLAHOMA CITY • NEW YORK

Economic Analysis Is Made of Direct Current Rotary Drilling Equipment and Steam Power

By D. M. McCARGAR and OSCAR A. HAAS
Allis-Chalmers Manufacturing Co.*

Direct current drives for the drilling of oil wells electrically have, no doubt, successfully passed through their experimental stage. They have proved to a great extent, that the wide range of power flexibility, especially so desirable for rotary drilling, and heretofore only thought attainable with steam, is an inherent feature that lends itself readily to most any drilling condition encountered; they have definitely proved their fuel economies and have further proved that continuity of operation in the neighborhood of 100 per cent can be expected.

and curves represent that obtained during the drilling of a well in the Lucien Field, Noble County, Oklahoma, in the spring of 1933, from the time the plug was drilled out of the surface pipe until the 9-inch casing was set at 5,145 feet. Although drives of a similar design have been used before for drilling oil wells, they were not as large as the equipment from which these data were collected.

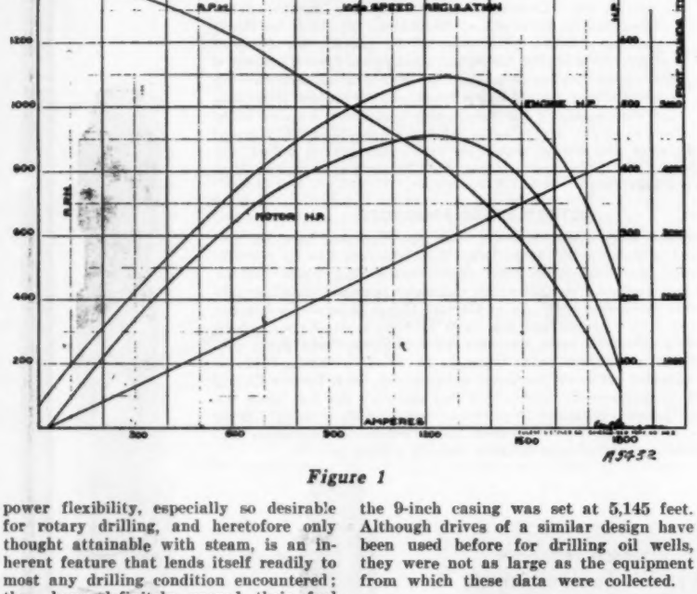


Figure 1

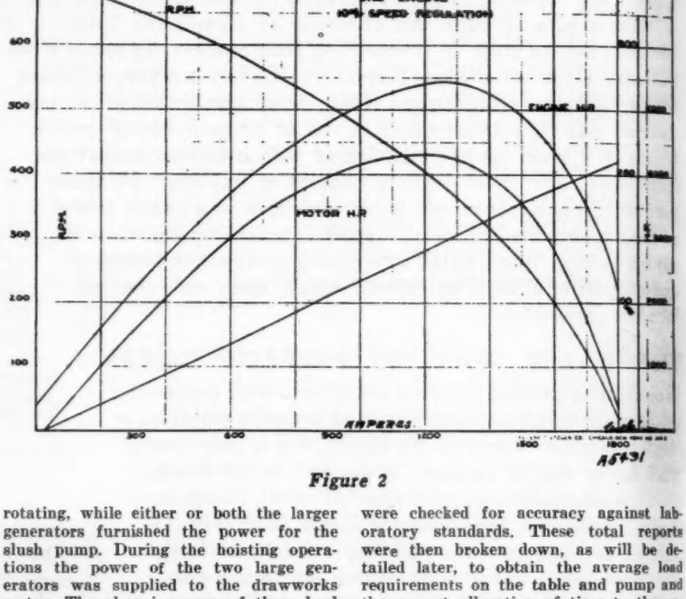


Figure 2

Equipment Used

The power plant for this direct current drive consisted of two engine driven generator units. The drawworks was powered by a fully protected D.C. Hoist motor, as well as were the slush pumps, and all motors were forced draft ventilated. Each of the engine units consisted of a high speed multi-cylinder gas engine direct connected by means of a flexible coupling to two different sized direct current generators mounted on the same shaft. This engine and generator assembly was then mounted on a common skid base presenting an appearance as shown in Figure No. 1, while the drawworks motor is shown in Figure No. 2 and the Slush pump motor in Figure No. 3. The smaller of the two generators on either or both of the units was used to supply power to the drawworks motor during rotating, while either or both the larger generators furnished the power for the slush pump. During the hoisting operations the power of the two large generators was supplied to the drawworks motor. The changing over of these load conditions on the generators was accomplished by the use of a control, also shown in Figure No. 1, while the schematic arrangement and possible switching setup obtainable with this control is shown in Table No. 2. The regulation of the various motors during the actual operations was accomplished by the use of a "headache" post control consisting of two handwheels similar to those for governing the throttle on a steam engine.

A daily record, of which Table No. 1 is a sample, covering hourly readings of the various instruments and notations regarding down time, was maintained during the time necessary to drill the well, as above mentioned. At various intervals the D.C. ammeter and voltmeter were checked for accuracy against laboratory standards. These total reports were then broken down, as will be detailed later, to obtain the average load requirements on the table and pump and the correct allocation of time to the various duties during the drilling of the well. No detailed record was maintained covering the hoisting operations at all depths. However, it is believed sufficient information on hoisting was obtained to make this paper complete.

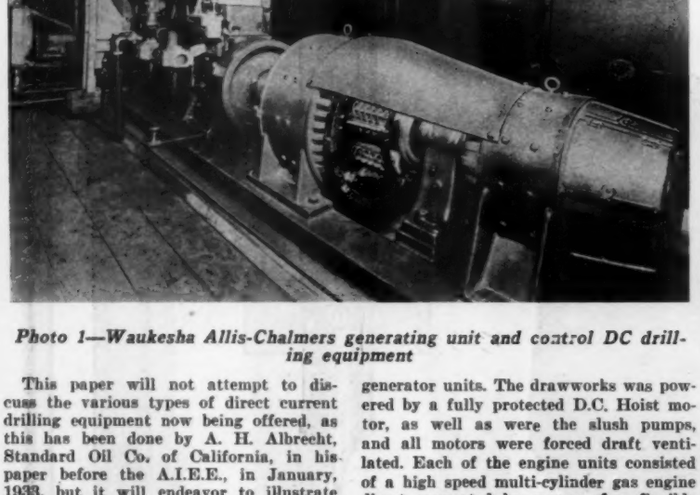


Photo 1—Waukesha Allis-Chalmers generating unit and control DC drilling equipment

Photo 2—Hoist and drill motor

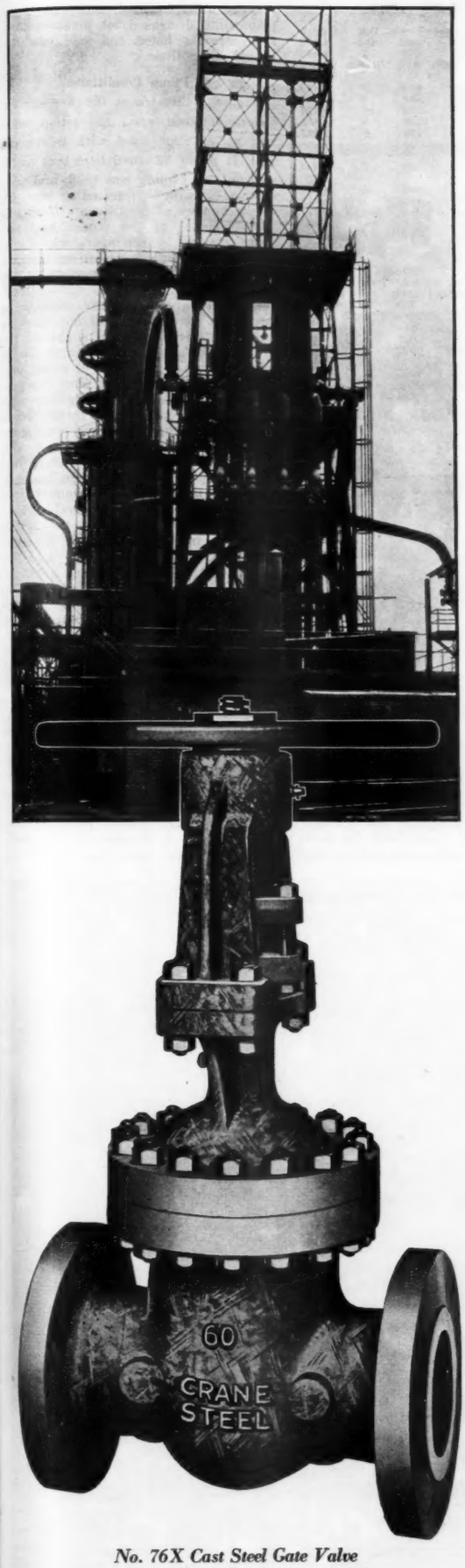
This paper will not attempt to discuss the various types of direct current drilling equipment now being offered, as this has been done by A. H. Albrecht, Standard Oil Co. of California, in his paper before the A.I.E.E., in January, 1933, but it will endeavor to illustrate the actual conditions of operations encountered while drilling an oil well with such a drive and a comparison with steam power.

The data used in the following tables

Information Shown in Curves

Before going into the actual load conditions imposed upon the drives, it will be interesting to refer to Figure 1. These curves illustrate the characteristics of two 300-horsepower engine driven units, pictured in Photograph 1, operating to-

*Prepared for meeting A.S.M.E., Tulsa.



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Cast Steel

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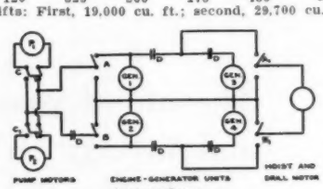
2-hole and 4-hole Box Header Return Bends

gether, and the load that can be imposed upon the engines by a 400-horsepower drawworks motor during a hoisting operation. The engine horsepower curve represents the maximum output of the two engines necessary to supply the hoist motor under any condition, by taking any point on the motor curve and projecting it upward until it intersects the engine curve. It will be noted that the heaviest motor load attainable does not require the full 600 horsepower available in the two engines. This protection, or impossibility of overloading the engines is due to the drooping voltage characteristic of the generator made possible by the differential winding. These curves also show the torque characteristics of the hoist motor, reaching a maximum under almost zero speed, thereby making it possible to meet the high torque conditions so necessary in the setting of a long string of heavy casing, "to handle stuck drill pipe," fishing jobs, etc. By referring to Figure 2 it will be noted that the hoist motor develops the same amount of torque with only one engine set operating, as it does with two, making it possible to perform all the drilling duties with only one engine unit as readily as with two, the only limitation being that the speeds are reduced. Figure 2 is identical to Figure 1, only it illustrates the load characteristics of a single engine.

Figure 3 shows the average conditions encountered rotating the table while using 6⅝-inch drill pipe for the total depth of the well with an 11¼-inch bit. It will be noted that the actual power requirements for rotating the bit are comparatively small, but that the loads increase with the depth reaching a maximum and then appearing to decrease. This characteristic appears to be justified when comparing with the apparent decreased weight on the bit together with a decreased speed of the table. Although, in general, it appears that the loads required for rotating in the Mid-Continent area are higher than those for similar work in California, the general appearance of the power curve conforms well to that obtained by J. R. Gignoux and R. A. March, Shell company, California, on California practice and presented in their paper to the American Petroleum Institute at the 1929 meeting in Chicago. It is also interesting to note that both the average power requirements and rotative speeds vary gradually and are not greatly affected by depth, and although the tendency for higher rotative speeds may be fully realized, but with a corresponding decreased bit pressure to insure straight holes, the load conditions should alter little.

TABLE NO. 1—LOG OF GAS ELECTRIC DRILLING EQUIPMENT
No. 1 Jerome, March 27, 1933

Time	Engine rpm. No. 1	Engine rpm. No. 2	Hoist motor V.	Hoist motor Amps.	Hoist motor Rpm.	Pump motor V.	Pump motor Amps.	Pump motor Spm.	Pump motor Press.	Wt. log	Depth
12	850	850	105	300	290	155	380	30	450	8	4,413
	At 1:45 engine No. 2 was shut down as one engine could furnish sufficient power and speed as was required.										
1	850	...	115	275	310	120	470	30	425	8	4,419
2	850	...	115	300	310	120	370	30	400	8	4,425
3	850	...	115	300	310	125	400	32	400	8	4,431
4	850	...	115	325	300	120	300	30	350	9	4,435
5	850	...	115	325	300	120	320	30	375	9	4,438
6	850	...	115	300	300	120	300	30	350	9	4,441
	Started up engine No. 2 at 6:50.										
7	850	850	90	350	230	170	120	30	250	9	4,444
	Jetted pits from 7:15 to 8:10.										
9	850	850	110	300	300	165	380	28	400	9	4,449
10	850	850	110	300	300	165	380	28	400	9	4,452
11	850	850	120	380	280	165	380	30	400	8	4,455
12	850	850	120	400	300	165	360	28	400	9	4,459
1	850	850	120	400	250	165	360	28	400	9	4,464
	Exciter Engine No. 270,706, installed new head gasket. Changed oil using 8 quarts.										
2	850	850	120	400	250	165	360	28	400	9	4,470
	Started out at 2:30. Out at 4:10 with 5 minutes changing crews. Put on Reed bit and changed reamers in shank and at same time jetted from reserve pit. Started in hole at 5:10, down at 5:30 with broken latch pin. Pin was not the right design but finally fitted and continued in hole at 6:20. Down from 6:35 to 6:50 filling pipe and getting circulation in at 7:15. On bottom 7:30.										
8	850	850	145	310	380	180	490	33	500	9	4,473
9	850	850	175	350	440	195	440	36	500	8	4,478
10	850	850	170	375	420	200	475	38	525	9	4,484
11	850	850	165	400	420	190	490	36	525	9	4,488
12	850	850	120	325	200	175	430	34	500	8	4,489
	Gas used on shifts: First, 19,000 cu. ft.; second, 29,700 cu. ft.; third, 29,700 cu. ft.										



Connection Diagram.

TABLE 2—SWITCHING SETUPS

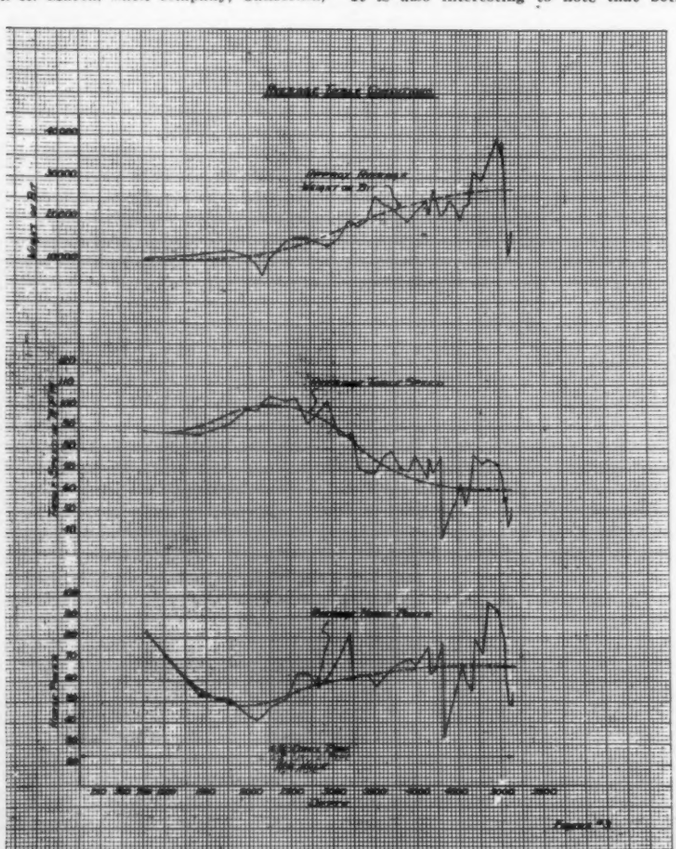
Operation—	Engine unit	Switch position— Up	Switch position— Down
Drilling, pumping, hoisting	No. 1	A, A_1, B, B_1	.....
Drilling, pumping, hoisting	No. 2	.....	A, A_1, B, B_1
Drilling, pumping, hoisting	No. 1 and 2	A, A_1	B, B_1
Drilling and hoisting	No. 1	$A_1 B_1$	A, B
Pumping	No. 2		
Pumping	No. 1	A, B	A_1, B_1
Drilling and hoisting	No. 2		

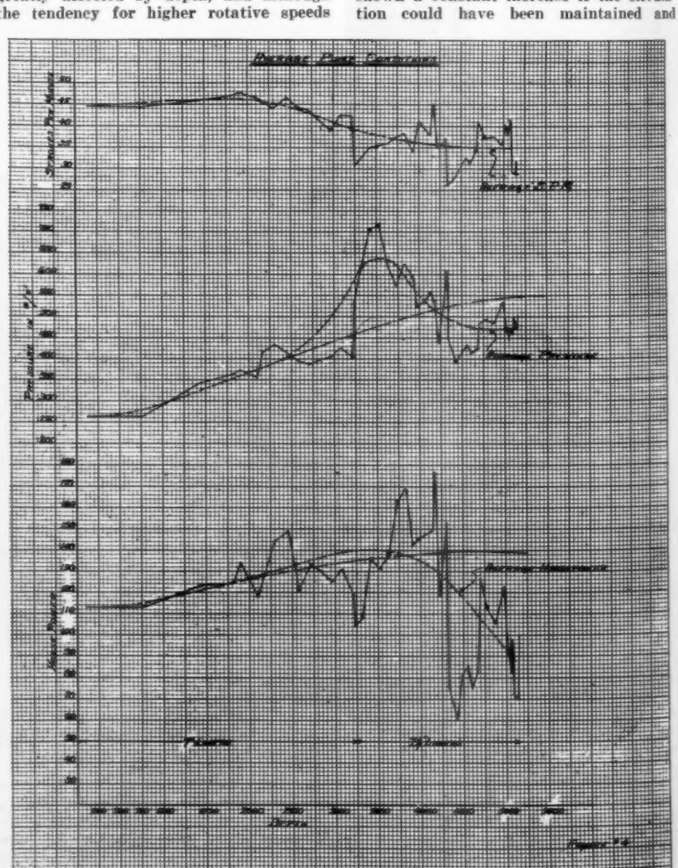
When switching setups are made driller can switch from drilling and pumping to hoisting, and vice versa, at will and without leaving the "headache post," by means of an explosion proof controller which in turn operates the contactors D.

Either pump can be operated by closing C or C_1, or both pumps may be operated at once so that mud can be mixed without interfering with the drilling operation.

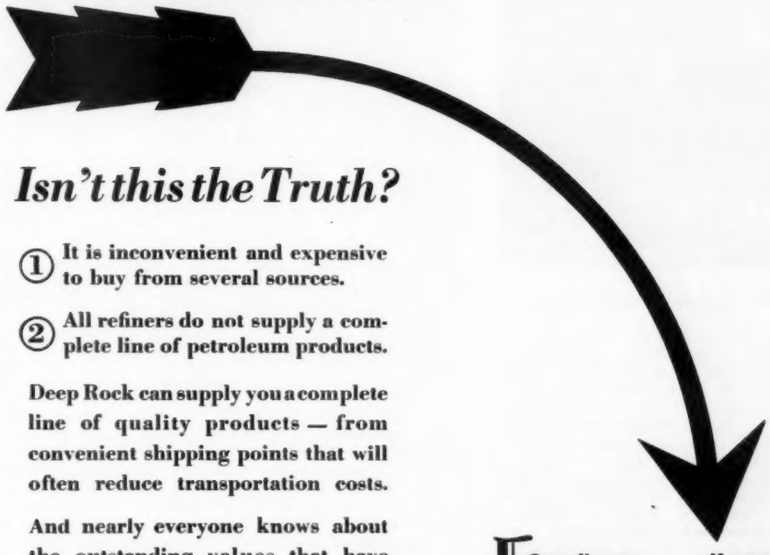
Pump Conditions

Figure 4 illustrates the average conditions imposed upon the pump, which was a 7¼"x20" used with 6-inch drill pipe. It might be noted here that on this well only one pump was used, and which setup will again be referred to later. Due to the number of conditions affecting the characteristics of the pumps and their interpretation by the operators, a great diversity of opinions regarding the proper operating of the pumps exists. In view of this, it is practically impossible to obtain accurate pump data, even on adjoining locations that will not vary perceptibly. Therefore, it is suggested that the data offered in this paper not be considered as a criterion of pump practice, but merely averages that can probably be expected under similar conditions. However, it was interesting to note that, in the same field, with greatly increased pressures and speeds without any perceptible gain in drilling time, but corresponding increases in loads, the resulting mechanical maintenance and down time increased considerably. From the curves it is seen that the average pressures increase gradually with the depth until about 3,000 feet and then increase rapidly until about 3,800 feet and then again decrease. The sudden increase and then corresponding decrease was evidently due to excessive trouble encountered with plugged bits and inability to retain circulation. If circulation could have been maintained this curve would probably have approached the one shown by the dot and dash line. The average speed curve of the pump shows very little change over the entire depth of the well. The average horsepower, gradually increased with the depth until the above mentioned difficulties with the pump operations were encountered and then decreased rapidly. This curve, too, would probably have shown a constant increase if the circulation could have been maintained and





A COMPLETE LINE



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probably approached the one also shown by the dot and dash line.

Although higher pressures are required for emergency conditions it appears that a possibility exists, of operating, under comparable conditions, at lower pressures and speeds than is ordinarily believed, with unquestionable economic advantages.

Figure 5 shows the time, in per cent of the total drilling time, for various duties, and down times, encountered during the drilling of the well. The time for the "bit on bottom" checks very closely with other similar tests conducted, while the other allotted times will of course vary with conditions. The down time charged against the pump, no doubt, would have appeared negligible, if two pumps instead of only one pump would have been used. The time lost due to circulating troubles was caused by inability to keep up circulation because of difficulties presented by formations and probable lack of drilling information in this field, as this was one of the earlier wells drilled. The miscellaneous down time includes mixing and preparing mud, which was watched carefully due to circulating troubles; jetting pits, etc., which would also have been decreased if two pumps had been used. The miscellaneous time also includes assembling and breaking down core barrel, which was done frequently. The time chargeable to the drill pipe covered the welding of some of the tool joints. It will be noted that the time during which all operations had to be stopped due to a lack of power from the generating plant amounted to only .2 of 1 per cent, or obtaining almost 100 per cent reliability.

In view of steam power being the most generally preferred method of drilling oil wells an economic comparison between such a drive of comparable rating, and the direct current drive is offered covering only such essential points as drilling time, fuel and water consumption, and possible hoisting requirements.

Figure 6 shows a comparison between the drilling time of steam and that of a direct current drive. The steam curves are a reproduction of the data gathered by K. Covell and others at Oklahoma City and referred to here because of the somewhat similar drilling conditions. The dotted curve is the average of 25 wells drilled at Oklahoma City in 1929, while the dot and dash curve is the average of 9 wells drilled in 1932, evidently showing that a knowledge of the conditions and probable changes in the design of equipment enabled the operator to gradually better the necessary drilling time. The direct current curve covers only the second well drilled with this particular equipment and one of the first wells drilled in the Lucien Field. It is observed that the direct current drive is a trifle faster than the average steam job in Oklahoma City in 1929, even though delayed by a lack of definite drilling information and in the Lucien Field and other mechanical troubles which could have been prevented. Anticipating the correction of such difficulties it appears that the drilling time of the direct current drive would approach the average steam job made in Oklahoma City in 1932, and appears to be substantiated by the last five wells drilled by this equipment since the taking of these data for this paper.

In Figure 7 a comparison of fuel and water consumption for steam and direct current drives is shown. Here again the work of K. Covell at Oklahoma City is referred to, and also the A.S.M.E. Report on Steam Drilling Equipment in 1932 covering similar data in the Oklahoma City Field. The gas consumption of a direct current drive only amounts to about 18 per cent of that necessary for a steam rig. The water requirements for the engines only on the direct current drive amounts to only about 1½ per cent of the amount necessary for the boilers only for a steam drive, while the total water to the location on the direct current drive amounts to approximately 40 per cent of that required for a steam job.

For a comparison of hoisting conditions Figure 8 is offered. The load time curve for the steam drive represents the approximate average conditions for hoisting a string of drill pipe by this method from 4,000 feet, and is obtained from the data in the A.S.M.E. report on "Steam Equipment for Drilling Rotary Drilled Oil Wells," 1932. The direct current drive curve represents similar average conditions while doing the same work. It will be noted that the direct current curve is slightly slower for the heavy loads, but faster on the medium loads. On the last five wells drilled it was possible to approach the hoisting conditions illustrated in Figure 9 by some modifications of operations and adjustment of equipment. The curves in

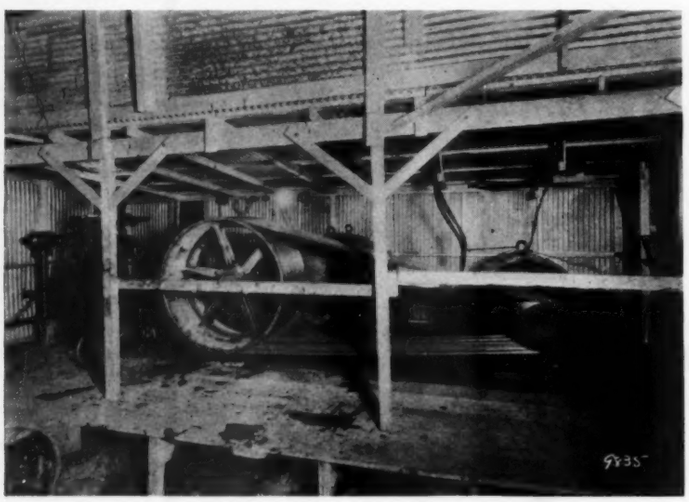
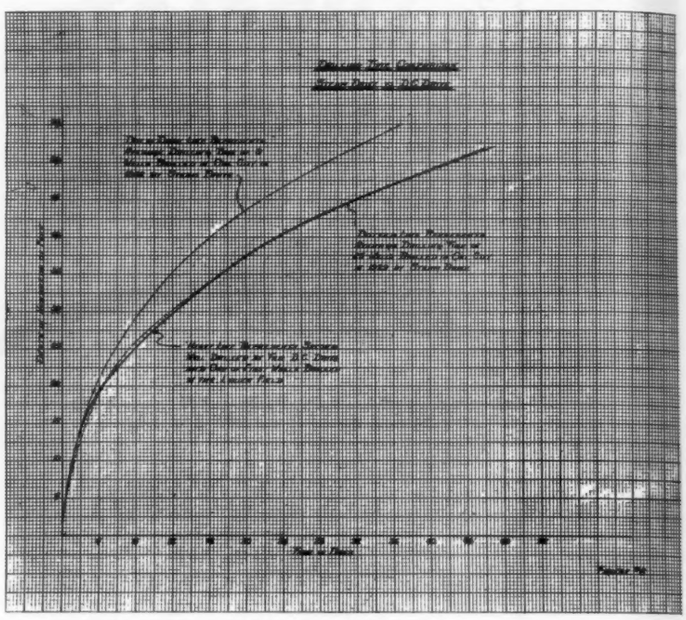


Photo 3—Drilling motor and Texrope drive operating slush pump



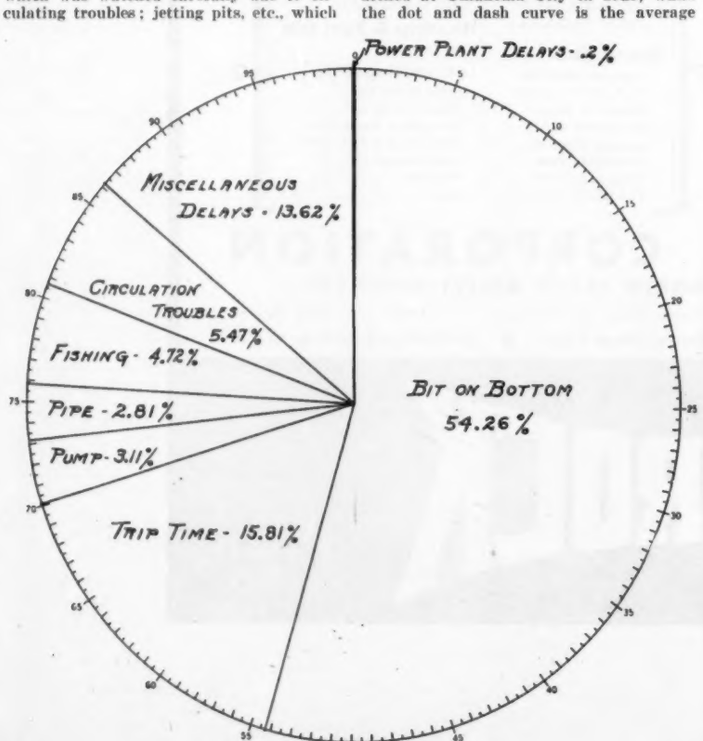


Figure 5—Operating analysis

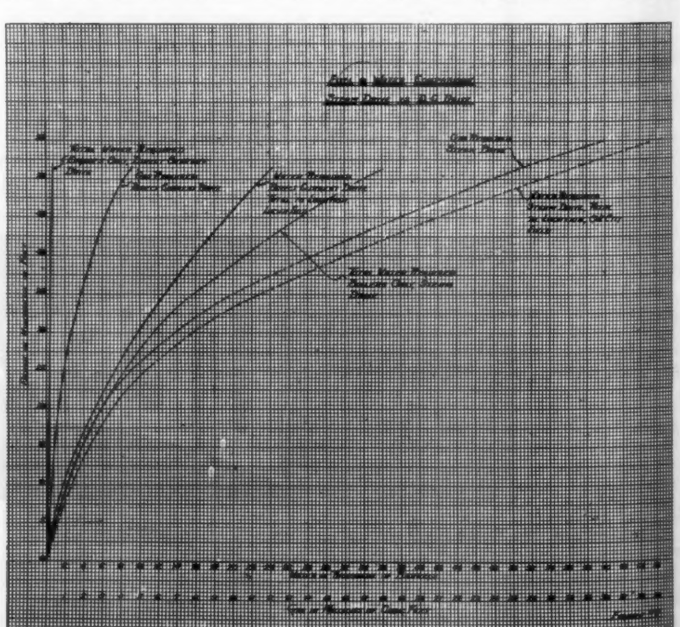
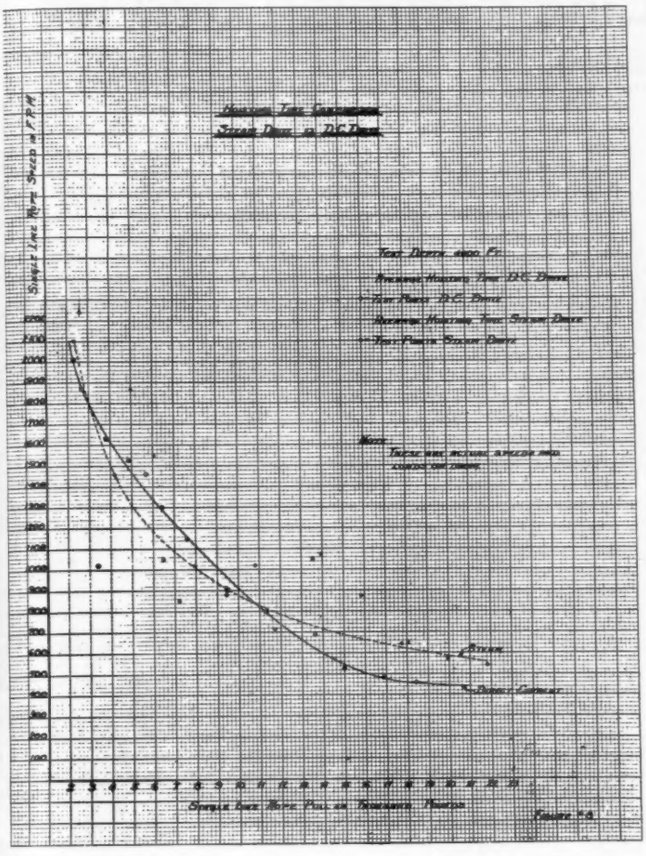
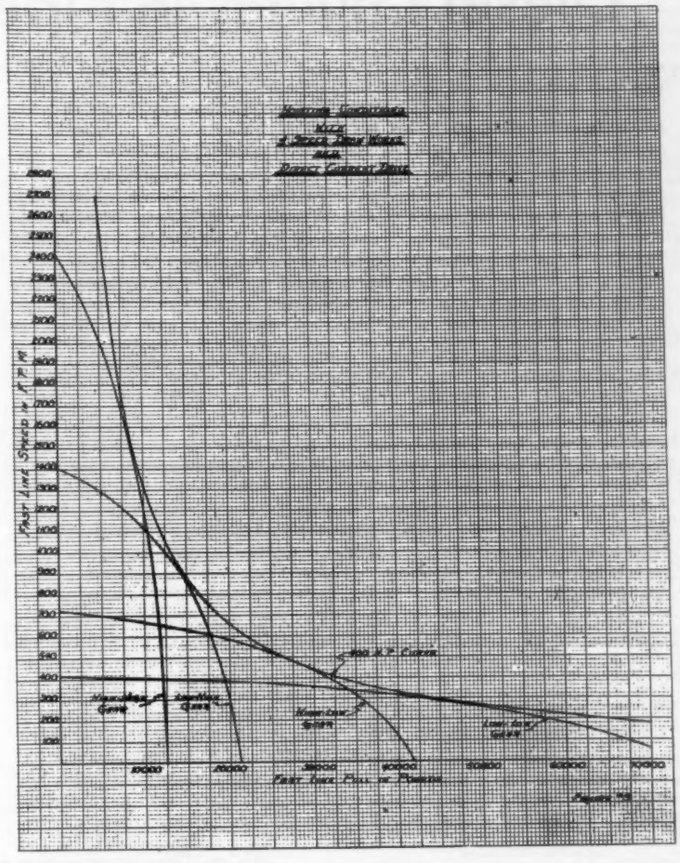


Figure 9 show how the speeds and loads with the same four speed drawworks used while obtaining the data for Figure 8. On comparing loads shown on the direct current curve of Figure 8 with corresponding loads of Figure 9 it is found that the latter is approximately 30 per cent faster.

Time and space limits the the possibility of further comparison between these two drives; however, in general, it appears that direct current drives compare favorably with the desirable characteristics of steam for speed and power, and prove themselves decidedly more economical for fuel and water.

A deep expression of gratitude is offered Messrs. Seymoure and Pinkerton, graduate engineers, who ran tour on this drilling well gathering the detailed data and making this paper possible. Further appreciation is tendered the Arrow Drilling Co. for its co-operation and assistance in accumulating this data; the Sinclair Prairie Oil Co.'s assistance in obtaining the water requirements; the Cities Service Co. for the information on fuel consumption, and N. Wilkinson, direct current designing engineer, of the Allis-Chalmers Manufacturing Co., for his assistance with preparation of the curves.





Tanker Turned Into Transport to Carry Pipe Line Equipment to Bahrein Island

Transporting oil cargoes is a routine business. But now and then romance comes aboard an oil tanker to interrupt the even tenor of its ways. For an interesting example of such deviation from a prescribed course, says the Standard Oil Bulletin, consider the Standard Oil Co. of California's tanker El Segundo, at present engaged in as romantic a bit of voyaging as ever comes the way of a merchant ship.

This sturdy steam tankship has become an expeditionary vessel to the far Persian Gulf, almost 180 degrees of longitude, or half way round the earth, from San Francisco. The expedition is for the purpose of constructing a marine loading terminal to make available for marketing the newly discovered oil on Bahrein Island, the largest of a group of islands which forms the independent state of Bahrein. A previous article in the World issue of The Oil and Gas Journal (December 28, 1933, page 94), discussed the region and told of the prospecting and drilling activities there. In April, 1930, a party of geologists landed on the island to survey the lands covered by the concession granted by the Sheikh. Following careful surveys, a favorable report was made, and drilling was started in 1931. About a year later the first well "came in," and since that time production has been brought to the commercial stage by the Bahrein Petroleum Co., Ltd., a wholly owned subsidiary of the Standard Oil Co. of California.

The construction work of the marine loading terminal includes laying over 3 miles of 12-inch submarine pipe line from the small island of Sitrah out into the harbor, terminating in 50 feet of water; erecting three crude oil working tanks with floating roofs on Sitrah Island, with a capacity of 250,000 bbls., and a 7,500-bbl. tank for ship's ballast water; laying more than 10 miles of gathering lines from the producing area to the terminal; providing a pumping plant with a capacity of 5,700 bbls. of oil an hour, housed in a dust-proof building — for "shamals," the local sand storms, sometimes make life in Bahrein somewhat of a burden; installing four sets of radio telephones for communication between ship and shore, and a telephone line connecting with the present line on Bahrein Island; and building a road to the terminal, including a fill or a trestle 1,200 feet long and a drawbridge across the channel between the two islands. These loading facilities will be able to handle 10,000 bbls. of oil a day, with provision for adding booster pumps to double that capacity.

Labor of Months

This work will require several months to complete. When the tanker then leaves her anchorage she will be laden with Bahrein crude, taken aboard by means of these new loading facilities, the materials for which she carried across the Pacific. She is expected to arrive in San Francisco about September 1.

Few merchant ships have ever outfitted as the El Segundo did; her case more nearly parallels that of a ship equipped for an Arctic expedition, for she will be far from sources of supplies. Fuel for the round trip, and everything necessary for the subsistence of the 45 men aboard for nine months, were taken at San Francisco, San Pedro, and Bombay, because white men can not safely eat native Arabian food, and Bahrein water must be boiled before drinking. In addition, the craft was loaded with miles of pipe, sheet steel for tank construction, five 8-ton anchors, six marking buoys, three trucks, a trailer, two tractors, numerous air compressors, electric welding generators for the work of welding pipe lines and the bottoms of tanks, a derrick and an unloading platform for landing freight from lighters that operate between ship and shore, and innumerable other items of equipment, tools and materials, the list of which reads like an inventory of a combination machine ship and boiler factory. Cargo booms were added to the ship's masts—incongruous aboard a tanker, whose normal cargo is taken on and discharged through hoses.

Under Torrid Sun

The vessel arrived at Bahrein on February 22, and is now anchored in deep water 16,000 feet offshore. Here, more than 3 miles out, the shallow water ends, and it is across this reach of shallow bottom that the loading pipe line will go, its hose-fitted discharging end marked by a buoy. Radiating from this point the five huge anchors will be placed, their heavy chains attached to marking buoys. When a tanker arrives for loading she will make fast to these anchors and be securely held in position. Here the El Segundo lies under the torrid sun, the floating home of the engineers, structural workers, divers and others of the personnel during the construction period. A channel 30 miles long is also to be charted and marked for the safe entry of tankers to the harbor. This work will probably be done in conjunction with the British Admiralty.

A skeleton crew remains on watch aboard the ship; the balance forms part of the construction force. Living quarters in a tanker are never very plentiful, but provision has been made for all, and the personnel is as comfortable as the torrid temperature (in summer, around 120° F. at midday) will permit. Suitable facilities have also been provided for the entertainment of Sheikh Hamad and his officials.

Some miles from the loading terminal are the rich pearl-banks which furnish the island's chief industry. Of late years, however, the income from the pearl fisheries has fallen off, owing to world conditions, and for this reason the coming of the oil drillers and the attendant royalty payments were looked upon much more favorably than might otherwise have been the case. Now the oil is flowing, and the problem of getting it from the wells to the distant anchorage is occupying the working hours of the tanker's crew. Such hours, during the summer months—from May to October—are usually from 6 a.m. to 1 p.m., owing to the terrific heat and the extreme humidity. So in preparation for this hot spell such necessities as pith helmets, spine pads, and other clothing designed for tropical wear were picked up at Bombay when the El Segundo put in there for water and for some final supplies.

There is an abundance of oil in the Western World, but a far less abundant supply for the great populations of the Eastern World. A tremendous potential market awaits the petroleum industry in that territory, and there the Bahrein oil will probably find its outlet.

XUM

Methods Used in Making Repairs on Heavy Duty Diesel Engines in Pipe Line Pumping Service

By J. B. HARSHMAN
Stanolind Pipe Line Co.*

In the operation of Diesel engines one is occasionally confronted with an emergency repair job which is brought about by the failure of some major part of the engine.

It is the purpose of this paper to described and illustrate some methods used in making such repairs on heavy duty Diesel engines in pipe line pumping service. The following subjects will be discussed in their respective order:

1. Repair of cracked bed plate, or engine frame.
2. Straightening crankshafts and repair of broken shafts.
3. Straightening bent connecting rods.
4. Welding cracked cylinder heads.

Repairing Broken Bed Plate or Frame

The failure of a connecting rod bolt, or of some reciprocating part of the engine often results in serious damage. In some cases the bed plate, or frame, which is one of the most expensive parts of an

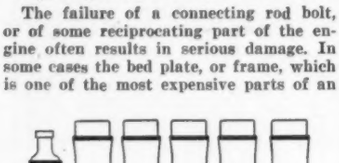


Figure 1—Showing vertical engine with broken bed plate, which was repaired by brazing. The arrows indicate the desired direction of stresses after hammering the brazed surfaces

engine, is broken and must either be successfully repaired or replaced at a great expense.

The type of repair to be used depends largely upon the location of the break and the amount of stress this part of the engine is subjected to. For instance, the type of repair suitable for a break in the bed plate below the crankshaft centerline, where the load is all downward, might not be desirable for use in the frame where there is a tensile stress.

1. The broken bed plate in Figure 1 was caused by the failure of a crankbolt which permitted the connecting rod to be thrown into the side of the engine, breaking several pieces out of the bed plate casting.

Since the break was located at a point where no great amount of strength was required, it was decided to make the repair by brazing. Measurements of the opening were taken for a pattern and a casting was made to fit the opening. Both the casting and the opening in the bed plate were beveled and the new casting was bolted into place.

The brazing was done in the usual manner. The torch was applied for only a short period of time at any one point to prevent an accumulation of heat in the casting which might set up stresses that would crack the bed plate at some other point. The welder was followed as closely as possible and the hot metal hammered while cooling to prevent excessive contraction. It is desirable to have the stresses acting in an outward direction from the braze.

After the work of brazing the new piece into place was completed, the rough surfaces were finished and painted, after which the repair could hardly be detected and the operation of the engine was never affected in any way.

*Prepared for meeting of A.S.M.E., Tulsa.

2. Another case of a failure of this kind is illustrated in Figure 2.

In this instance the damage occurred in the frame of a horizontal engine at a point where the load stresses made it necessary to use a type of repair to secure the greatest strength. This repair was made by the use of a shrink link similar to that used in the rim of a flywheel. The link was made to the required dimensions from a good grade of steel and an outline of the link was laid out across the crack in the engine frame. The metal was then drilled and chipped out to allow the link to be inserted flush with the side of the frame.

The distance "A," shown in Figure 2, was made greater than the link at this point to allow for the shrink fit; an allowance of five-thousandths per inch of length plus the width of the crack is sufficient for links up to 10 or 12 inches. The proper allowance is quite important, as the success of the repair depends upon the link closing the crack tightly to prevent working at this point. The link is heated until sufficient expansion takes place to allow it to be placed in the opening in the frame. After the link cools, the clearance around it may be filled with iron cement to improve the appearance. It is possible, through careful workmanship and the proper proportioning of the link to obtain a finished job which serves as well as the original casting.

3. In the case of the failure of an engine frame at a point where the metal

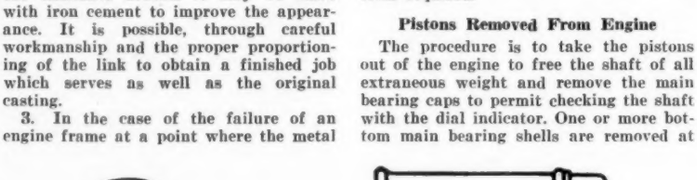


Figure 2—Showing the frame of a horizontal engine with a crack on the side of the frame near the cylinder

is too thin to use the shrink link, and the stresses are too great to permit welding or brazing, a method illustrated in Figure 3 is used:

In this case a piece of boiler plate of the proper thickness to provide the necessary strength is expanded by heat and then bolted to the frame. The holes are drilled and tapped in the frame on each side of the crack for the stud bolts; the corresponding holes in the plate are drilled on longer centers. The plate is heated and expanded until it will slip over the stud bolts in the frame, and then bolted securely in place. The contraction of the plate in cooling pulls the crack together and provides the necessary strength to the cracked casting. Although this type of repair serves its purpose for strength, it is not a neat job and should be used on the inside of the frame, if possible.

Straightening Crankshafts and Repair of Broken Shafts

1. The crankshaft of the average Diesel engine, if properly cared for, should give many years of trouble-free service; however, bent shafts are found occasionally in engines which have been in service for years. This condition may be the result of:

(a) Operating with main bearings out of alignment.

(b) Operation of horizontal engines with loose main bearings.

(c) An accident due to the failure of some part.

(d) Careless handling of the shaft at the factory, at the time of erection or during repair jobs.

(e) Improper heat treatment of shaft at time of manufacture and failure to normalize stresses in the forging before the finished machining operation. Such shafts free themselves of these stresses during operation and go out of alignment.

A bent shaft, if operated for any great length of time in this condition, will fail due to fatigue and crystallization of the metal.

The straightening of a shaft of any size is a fairly simple matter. A small amount of heat, if applied to a bar of steel, will cause the bar to bend in the opposite direction from the point at which the heat is applied. After cooling, the bar will be found to have drawn back beyond its original position toward the point where the bar was heated. This principle is used in the straightening of the shaft.

A dial indicating gauge, registering in one-thousandths of an inch and an acetylene welding torch are about the only tools required.

Pistons Removed From Engine

The procedure is to take the pistons out of the engine to free the shaft of all extraneous weight and remove the main bearing caps to permit checking the shaft with the dial indicator. One or more bottom main bearing shells are removed at the point where the shaft shows the greatest deflection to prevent the bearings from holding any of the deflection out of the shaft. One should then be able to get an accurate check on the shaft with the dial indicator to determine the amount the shaft is sprung. It is important to move the indicator along the shaft, locate the point of greatest deflection and work from this point. After this point is located the indicator is moved an even number of inches and another reading taken to determine the amount of deflection (in thousandths) per lineal inch along the shaft, which value is divided into the greatest measurement in thousandths. This computation locates the distance (in inches) of the point where the bend starts from the point of greatest deflection. Consider as an example a shaft showing an indicator reading of .075 inch maximum deflection and a reading of .0015 inch "spring" per lineal inch. Seventy-five thousandths divided by one and a half thousandths would show the bend to start 50 inches from this point. The heat must be applied at the point where the bend starts. The shaft is placed with this point upward and the arc of the bend downward. The indicator is again "set up" where the greatest deflection reading was obtained. As the heat is applied, the shaft bends downward into a still greater arc. This heat should be continued until the indicator shows a downward travel of the shaft of approximately twice the amount of the bend; at which time the shaft is permitted to cool for several hours. Within a short time the shaft will come back to its original position before the heat was applied, then gradually toward the true axis. After the shaft has thoroughly cooled it should be barred over and readings taken with the indicator to determine how much of the desired results were obtained in the first heat. Additional heats are made in the same manner until the indicator shows that when the shaft has cooled thoroughly to atmospheric temperature it has reached its true axis and, preferably, a few thousandths beyond.

The heat places a certain amount of stresses in the shaft at the point where it is applied. Some of these stresses will relieve themselves in operation and permit the shaft to go a few thousandths out of line. It has been found that an allowance approximately 10 per cent of the amount of the bend is sufficient to offset this; that is, the shaft should be drawn this much beyond its axis. My experience has been that crankshafts treated in this manner have remained in alignment and still check straight after several years.

The amount of heat required for the straightening process is small and the stresses set up are not great enough to be detrimental to the shaft. However, the straightening of the shaft will prolong its life. Failure will be the result of operating a shaft out of alignment for any great length of time.

2. Repair of broken crankshafts.

Modern heat treating methods, better grades of steel, and better workmanship

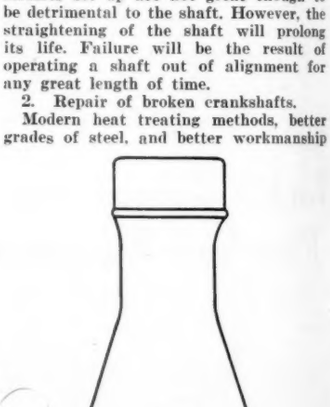


Figure 3—Showing cracked frame of large engine. Repaired with 5/8 inch thick boiler plate, expanded and bolted to frame over the crack

have resulted in better crankshafts, and a crankshaft failure in engines constructed in recent years seldom occurs. The principal causes of such failures are:

(a) Undue torsional strains brought about by critical speeds at certain points in the operating range of the engine.

(b) Misalignment of bearings, particularly the outboard bearing which carries considerable weight and wears down more rapidly than the main bearings.

Such a failure makes it necessary either to replace it with a new one or a rebuilt shaft.

Shafts can be rebuilt to give reliable service and the expense of such a repair

is about one-third of the cost of a new shaft. A shaft is rebuilt by cutting out the broken section, turning down the main journals, making a new crank web and crankpin and pressing these parts together. A shaft repaired in this manner should give years of additional service if the metal at some other point has not been fatigued. Such a repair should be done in shops equipped for such work and with an experienced personnel.

Straightening Connecting Rods

The neglect of an engineer in starting an engine with an accumulation of water in a cylinder often results in a bent connecting rod. The water may find its way into the cylinder by:

(a) An accumulation of water in the air intake piping.

(b) A leak from jacket directly into cylinder.

(c) The neglect of engineer to keep water blown out of air bottles which goes into cylinders with starting air.

(d) An accumulation of water in the exhaust header of an engine which has separate exhaust riser to each cylinder. If the header is filled with water, the cylinders when taking starting air will build up a pressure in the exhaust and force the water into the valve area of one of the adjoining cylinders and then into the cylinders when the exhaust valve opens.

The connecting rod of any diameter or length can be straightened if a heavy-duty steam hammer is available. A steel straightedge, slightly longer than the rod and a tri-square are the only instruments required. The center line between the bolt holes must be located, marked across the ends, and extended over the side on each end of the connecting rod to permit checking with the straightedge. The rod is heated in the bend to a dull cherry red and placed under the hammer, using a steel saddle or swaging tool of the proper radius to prevent flattening the rod. With light blows of the hammer the rod is straightened gradually until the center line on each end check in alignment with the straightedge; a tri-square is then used off the straightedge to check the surfaces on each end of the rod for being parallel with each other.

With proper care the rod may be straightened to within a few thousandths of its original accuracy. It should then be evenly heated throughout its entire length and placed in lime or in an oven for normalizing of stresses. After the rod has cooled it should be placed between centers in a lathe and a light cut taken off each end to insure accuracy for reassembling in the engine.

The cylinder heads of most engines of recent construction give very little trouble if operated free of scale deposits. However, it is not always possible to secure water free of scale-forming properties.

With the best of care under these conditions a cylinder head will fail occasionally. Until a few years ago a cracked cylinder head was considered as junk, but with modern welding methods and materials, it is possible to make a repair which makes it possible to obtain years of additional service from such heads.

A well insulated furnace for the purpose of preheating and normalizing the casting after welding, is required. Preparatory to the welding, the metal around the crack is chipped and machined. Should the crack extend through the shelf where the valves seat, it is best to machine this area out and prepare a shelf of new material, welding into place. The new shelf insures good material and freedom from pin holes for machined surfaces.

The head is placed in the furnace over a charcoal fire and is brought gradually to a dull cherry red heat. The welding is then done through a door in the side of the furnace without removing the head from the fire. A cast iron rod of the best quality obtainable is used with a good grade of flux. The welding of the casting is no different from the methods used in welding any heavy gray iron casting.

Proper preheating and cooling is the most important feature of the entire job. Unless the head is brought up to an even temperature after welding and allowed to cool slowly, it will crack at some other point, due to stresses set up within the casting from uneven temperatures. In our first repair jobs the furnace was closed tightly after welding, and from five to seven days were allowed for the head to cool. This method proved rather slow and a lime box was built so the heads could be removed from the furnace within 24 hours after welding and buried in the lime for the remainder of the normalizing process. This speeded up the work considerably and has proven just as satisfactory as leaving the head in the furnace.

In the case of damaged parts such as described in this paper, the Diesel engineer should consider that a great saving may be reflected by making repairs rather than replacing with new parts.

Careful observation and periodic inspections should of course be made on all repaired parts to make sure that the repair is adequate for the load and strain that the part is subjected to.

If the plant at which an accident occurs is not equipped to do such work, the repairs may be done by some company which specializes in Diesel engine repairs. There are several such concerns throughout the country.

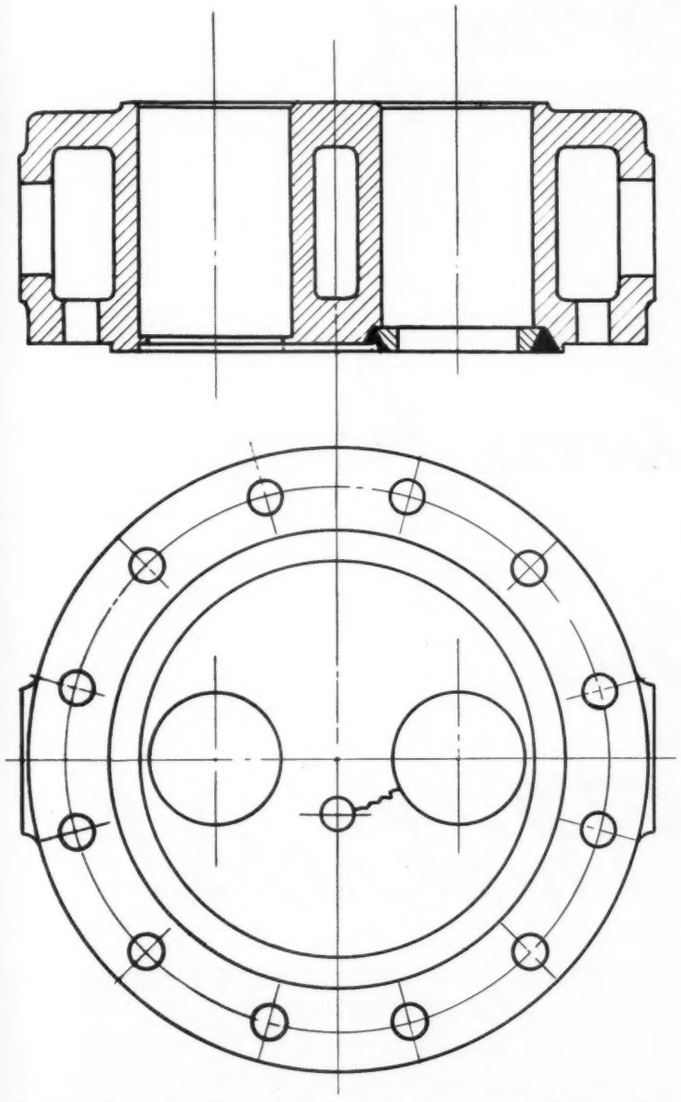


Figure 4—Showing cylinder head of a four cycle engine with crack from fuel valve to exhaust valve opening and repair made with new cast iron ring welded into place as shown in section

Program of Mid-Year A. P. I. Meeting at Pittsburgh, May 22 to May 24

The preliminary program for the fourth mid-year meeting of the American Petroleum Institute Divisions of Production, Refining and Marketing, to be held at the William Penn Hotel, Pittsburgh, Pa., May 22, 23 and 24, follows:

Wednesday, May 23—9:30 a.m.

Production Division

Eastern District topics.

Deep Sand Development in the Eastern Area:

Geology, C. E. Fralich, Torrey, Fralich & Simmons, Inc.

Operating and Development, F. E. Eckert, Hanley & Bird.

Motion picture, National Tube Co.

Refining Division—10 a.m.

Refinery problems.

Continuous Treating of Oils With Centrifugal Separation, Robert D. Walker. DeLaval Separator Co.

The Use of Centrifuge in Acid Treating Petroleum Stocks, Leo D. Jones. Sharples Specialty Co.

Percolation Filtration in the Light of Recent Process Developments. Stanard R. Funsten, Attapulgus Clay Co.

Economies in Refinery Operation in Relationship to A.P.I. Standardization Program, Arthur E. Pew, Jr., Sun Oil Co.

Marketing Division—10 a.m.

The "Code." Program to be announced.

General Session—2 p.m.

Production, Refining and Marketing.

Address, Axtell J. Byles.

Address, W. R. Boyd, Jr.

Address, Baird H. Markham, American Petroleum Industries Committee.

Production Division—8 p.m.

Metallurgy and Corrosion of Oil Field Equipment.

Use of Alloy Cast Iron in Oil Production Equipment, O. B. J. Frazier and J. S. Vanick, International Nickel Co.

Recent Improvements in Manufacturing Steel for Oil Field Equipment, C. H. Herty, Jr., director of research, Metallurgical Advisory Board to Carnegie Institute of Technology.

Magnetic Methods of Detecting Flaws and Fatigue Failures in Iron and Steel, A. V. DeForest, consulting metallurgical engineer.

Special Metals in Oil Field Practice, P. H. Brace, Westinghouse Electric & Manufacturing Co.

Thursday, May 24—9:30 a.m.

Production Division

Eastern District topics.

Care and Nursing of Small Wells East of the Mississippi:

Oil Properties. Speaker to be announced.

Gas Properties, J. H. Newlon. The Philadelphia Co.

Developments in Eastern Production Practice:

Water Flooding, J. B. McClintock, Sloan & Zook Cos.

Air and Gas Drives, C. C. Hogg, National Petroleum Co.

Chemical Treatment. Speaker to be announced.

Refining Division—10 a.m.

Automotive problems.

Economic Discussion of Methods of Obtaining High Octane Gasolines. Speaker to be announced.

Relation of Fuel Octane Number and Engine Compression Ratio, Earl Bartholomew and C. D. Hawley, Ethyl Gasoline Corp.

Conservation of Volatile Gasoline Materials, William Mendius and Walter Ainsley, Sinclair Refining Co.

Butane—A Waste Asset of the Petroleum Industry, R. C. Alden, Phillips Petroleum Co.

Marketing Division—10 a.m.

Marketing problems.

Training Lubrication Salesmen, W. J. Gerwe, Vacuum Oil Co.

What Does a Customer Think of Us? E. L. Barringer, National Petroleum News.

Subject and speaker to be announced.

Production Division—2 p.m.

General topics.

Primary Well Spacing, John R. Suman, Humble Oil & Refining Co.

Lower Lifting Costs Through Proper Pumping Methods, Herbert Stark, Honolulu Consolidated Oil Corp., and C. L. Moore, Chanslor-Canfield-Midway Oil Co.

Bottom Hole Pressure Conditions in Kettleman Hills, G. V. D. Marx, Standard Oil Co. of California.

Refining Division—2 p.m.

Refinery problems.

The Problem of Viscosity of Lubricants, M. R. Fenske and W. B. McCluer, Pennsylvania State College.

The Economics of Solvent Extraction of Lubricating Oils, R. E. Wilson, Standard Oil Co. (Indiana), and P. C. Keith, M. W. Kellogg Co.

The Distinction Between Heavy Fuels for Use in Spark and Compression Ignition Engines, James B. Fisher, Waukesha Motor Co.

See the Visible Proof that Tube-Turns have Uniform Wall Thickness!

YOUV'E read our statements that Tube-Turns are the ONLY seamless fittings for welding which *combine* these essential factors:

1. Full, uniform wall-thickness at *all* points—

—at the back, where flow impinges and where thickness and strength are needed most—

—at the ends, where good welding requires that the fitting must line up *exactly* with the pipe (and where perfect alignment is impossible unless the fitting is *uniform* and matches the pipe in *both* O. D. *and* I. D., and in wall-thickness.)

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Visit Booth 109

Uneconomic Operating Units Being Eliminated Gradually From Natural Gasoline Industry

By W. T. ZIEGENHAIN

The past year took its toll from among uneconomic units in the natural gasoline industry in the form of plant abandonments and consolidation of operations to reduce the total number of plants in the United States on March 1 to 882. Some new plants were built, however, and they were of relatively large capacity so the trend toward fewer but bigger units which started in 1928 was not interrupted. The net result was that the combined capacity of all units was not reduced greatly by reason of the lesser number of plants.

Adverse market conditions retarded the general expansion of natural gasoline plant operations over the first half of 1933 and the prorating of crude production in practically all fields kept many of the older plants from processing a normal volume of gas throughout the year. These factors, together with the natural decline in available gas that comes with the depleting of oil-bearing sands brought the total output of natural gasoline to 33,610,000 bbls. in 1933 compared with 36,281,000 bbls. in the previous year.

Conditions Improving

Over the first quarter of 1934, however, there has been a decided increase in new plant construction and reconditioning. The industry responded quickly to the 4 to 5-cent per gallon price received for its 26-70 material during November and December of last year and set out upon a program of new work only to find a declining market over the first quarter of 1934. Some improvement in price has been made since the 1½-cent price of April 1 but the present price is not generally profitable. Because of the prolonged period of low prices, only those new plants could be justified which were located in fields affording abnormal advantages. As a result, every one of the important natural gasoline manufacturing states showed a reduction in the number of plants within its borders. Texas, however, provided unusual operating advantages in two fields and stands in the unique position of having added several plants of large capacity. Texas also has several other relatively large plants under construction. The two areas that afforded opportunities for the erection of new plants in Texas were the Panhandle and East Texas.

Growth of Natural Gasoline Industry

	No. of plants	Daily capacity (gallons)
May 1, 1934	882	10,241,989
May 1, 1933	919	10,308,354
May 1, 1932	948	10,536,182
May 1, 1931	987	10,531,511
May 1, 1930	1,071	9,541,320
May 1, 1929	1,124	8,695,727
May 1, 1928	1,229	7,865,652
May 1, 1927	1,148	6,947,264
May 1, 1926	1,063	5,121,000
May 1, 1925	1,143	4,642,561
May 1, 1924	1,012	3,396,961

Plant Capacities by States

	Status of plants May 1 — No. of plants		Daily capacity (gals.)	
	1934	1933	1934	1933
Arkansas	9	10	72,450	70,450
California	138	144	3,676,730	3,790,730
Colorado	3	3	13,000	13,000
Illinois	62	64	45,688	47,993
Kansas	24	24	229,200	230,700
Kentucky	6	6	39,900	39,900
Louisiana	45	46	417,130	435,330
New Mexico	2	3	64,000	79,000
New York	2	3	900	1,900
Ohio	20	22	175,071	65,371
Oklahoma	202	215	2,247,916	2,253,466
Montana	1	0	5,000	0
Pennsylvania	126	130	126,329	118,400
Texas	136	139	2,537,900	2,566,900
West Virginia	96	101	390,815	392,254
Wyoming	10	9	199,960	202,960
Total	882	919	10,241,989	10,308,354

Note.—May 1, 1933, includes 159 plants with 1,092,835 gallons daily capacity listed as shut down. May 1, 1934, includes 112 plants with 961,238 gallons daily capacity listed as shut down.

In fact, what took place in these two fields during the past year gives a rather complete picture of what changes were made within the industry. A few months after the so-called "sour gas" law went into effect in Texas, the stampede to process large quantities of what was formerly considered dry gas added close to 200,000 gallons daily to the output of natural gasoline in Texas. This came from old plants and new plants. The litigation that followed and the efforts now being made to curb the wasteful practices permitted under the sour gas law are well known to all but there yet appears no prospect of early change.

Two large, modern plants were recently completed in the field and another is under construction, each of which has a gas processing capacity of about 110,000,000 feet daily and produces between 40,000 and 50,000 gallons of 26-70 material. These plants were built under agreement with state officials after the best available interpretation was obtained of the sour gas law. The modern construction employed in the plants suggests permanency. An equitable solution of the Panhandle problem would have to provide for the continued operation of these plants.

Of equal or probably greater influence in boosting natural gasoline production in the Panhandle has been the processing of greater quantities of "dry" gas through the older plants and with equal disregard for the use made of the residue. The net result of all this has been the weakening of a none too strong natural gasoline market to the point where prices are below a profitable level for the entire industry.

East Texas

In the East Texas Field the increasing number of plants is the direct result of the field's development for the production of oil. The area is nearing the saturation point in the number of wells that can be economically drilled there. Additional plants will be justifiable when it becomes necessary to pump these wells in large numbers and residue gas under pressure is needed for producing the oil. Because of these and other operating factors, the type of

(Continued on Page 160)

A typical Mid-Continent natural gasoline plant of the compression absorption type with stabilizer

Personnel of Natural Gasoline Companies in U. S.

ABBREVIATIONS:

Chm. Bd.—Chairman of Board
Pres.—President
V. P.—Vice President
Sec.—Secretary
Treas.—Treasurer
Gen. Mgr.—General Manager
Gen. Supt.—General Superintendent
Sales Mgr.—Sales Manager
Tank Car S. M.—Tank Car Sales Manager
Pur. Agt.—Purchasing Agent
Traf. Mgr.—Traffic Manager
Ch. Egr.—Chief Engineer
Supt.—Superintendent
Asst. Supt.—Assistant Superintendent
Ch. Chem.—Chief Chemist
Capacity—gallons per day.

A

Airolene Gasoline Corp., 723 Kennedy Bldg., Tulsa, Okla.
Pres., Forrest E. Gilmore
V. P., Carl W. Gilmore
Sec.-Treas., H. O. Whitfield
Gen. Supt., Carl W. Gilmore
Supt. and Pur. Agt., Jess Patterson, Box 772, Shamrock, Tex.
Plant in Texas
Capacity, 8,000

Akin Gasoline Co., 1801 National Bank of Tulsa Bldg., Tulsa, Okla.
Pres., J. H. McCoy
V. P., C. M. Withington
Sec.-Treas., H. R. Johnson
Sales Mgr., A. J. Pfister
Pur. Agt., W. S. Cox
Plants in Oklahoma
Capacity, 2,000

Alum Rock Gas Co., National Transit Bldg., Oil City, Pa.
Pres., R. P. Stevens, 120 Broadway, New York City
V. P., J. H. Isherwood, Port Allegany, Pa.
Sec., J. C. Forsyth
Treas., C. R. Beddows, 120 Broadway, New York City
Supt., Roy Klinger, Knox, Pa.
Plant in Pennsylvania
Capacity, 200

Amerada Petroleum Corp., 120 Broadway, New York City
Pres., A. Jacobsen
V. P., A. M. Blow
Sec., Robert Nock
Treas., E. P. Potter
Gen. Supt., M. E. Mockly
Pur. Agt., A. E. Cook
Ch. Egr., H. W. Harts
Supts., F. E. Thompson, Drawer C, Fry, Tex.; J. W. Kearney, Box 686, Healdton, Okla.; E. G. Lyons, Box 37, Harjo, Okla.; I. N. Journeycake, R.F.D. 8, Oklahoma City, Okla.
Plants in Oklahoma and Texas
Capacity, 82,000

American Oil Development Co., 1601 Oliver Bldg., Pittsburgh, Pa.
Pres., Harry S. Tack
V. P. and Gen Mgr., Theodore E. Tack
Sec., Willis Siegfried
Treas., A. V. Tack
Gen. Supt., John Petty
Supts., G. H. Hayes, Box 125, Robinson, Ill.; S. E. Hoover, Middlebourne, W. Va.; M. T. Hooper, St. Marys, W. Va.; G. G. Morgan, Meadeville, W. Va.; J. H. Petty, Fly, Monroe County, Ohio; H. G. Bradfield, R.F.D. 2, New Matamoras, Ohio.
Plants in West Virginia and Illinois
Capacity, 1,400

Arab Gasoline Corp., Exchange National Bank Bldg., Eastland, Tex.
Pres., Samuel Butler
Sec.-Treas., W. E. Cox, Philadelphia, Pa.
Gen. Supt., Franklin Dwyer
Pur. Agt., R. L. Allen
Ch. Egr., W. E. Coleman
Supt., Franklin Dwyer, Eastland, Tex.
Plant in Texas
Capacity, 25,000

Arkansas Natural Gas Companies (including Arkansas Natural Gas Corp., Arkansas Fuel Oil Co. Arkansas-Louisiana Pipe Line Co., and Rodessa Natural Gas Co.), Ardis Bldg., Shreveport, La.
Pres., H. L. Doherty
V. P. and Gen. Mgr., D. W. Harris and J. R. Munce
Sec., T. J. Heard
Treas., B. R. Muirhead
Gen. Supt., A. H. Weyland
Ch. Egr., H. T. Goss
Pur. Agt., J. Lucas
Supts., C. Zeppa, Exchange Bldg., El Dorado, Ark.; L. A. Clements, Box 668, Homer, La.; J. P. Smithson, Rodessa, La.
Plants in Louisiana, Arkansas and Illinois
Capacity, 25,000

Atlas Oil Co., Main St., Clarion, Pa.
Plant in Pennsylvania
Capacity, 350

B

Bankline Oil Co., 634 S. Spring St., Los Angeles, Calif.
Pres., John Barneson
V. P., H. J. Barneson, Los Angeles
Sec.-Treas., W. E. Kropp
Gen. Mgr., L. L. Aubert
Pur. Agt., H. M. Paulsen
Supt., L. J. Patrosso, Box 6203, Signal Hill, Calif.
Plant in California
Capacity, 25,000

Barbary & Hardt, Wildwood, Pa.
Plant in Pennsylvania
Capacity, 11

Barco Gasoline Co., 1309 E. Fifteenth St., Tulsa, Okla.
Pres., R. A. Koons
V. P., A. D. Blackard
Treas., M. F. Powers
Sec., J. L. Goddard
Gen. Supt., J. H. Archer, Wirt, Okla.
Plant in Oklahoma
Capacity, 2,000

Barnsdall Oil Co. of California, Petroleum Securities Bldg., Los Angeles, Calif.
Pres., R. A. Broomfield
V. P.s, E. M. Skeehan, E. B. Reeser, James A. Dunn, W. C. Whaley, R. A. Broomfield, Jr.
Sec., James A. Dunn
Treas., E. C. Reed
Gen. Supt., O. Weaver
Pur. Agt., C. E. Good
Ch. Egr., R. B. Hastings
Supt., R. L. Fortune, P. O. Box 88, Golet, Calif.
Plant in California
Capacity, 65,000

Barnsdall Oil Co., Petroleum Bldg., Tulsa, Okla.
Pres., E. B. Reeser
V. P., W. K. Whiteford
Sec., James A. Dunn
Treas., L. D. Messner
Gen. Supt., A. J. Schlosser
Sales Mgr., George Locke
Pur. Agt., O. E. McClatchey
Ch. Egr., H. W. Manley
Supts., J. O. Green, Box 518, Earlsboro, Okla.; R. W. Shannon, Box 856, Beggs, Okla.; G. R. Nicholas, Box 228, Osage, Okla.; E. E. Troyer, Box 224, Avant, Okla.; C. C. Voris, Route 8, Tulsa, Okla.; F. C. Goughler, Route 1, Barnsdall, Okla.; A. H. Saylor, Route 2, Box 173, Oxford, Kans.
Plants in Oklahoma and Kansas
Capacity, 20,000

Bartlett Gasoline Co., 313 Wright Bldg., and 1801 Exchange Bank Bldg., Tulsa, Okla.
Pres., J. H. McCoy
V. P., Dean E. Foster
Sec.-Treas., H. R. Johnson
Gen. Supt., Dean E. Foster
Sales Mgr., A. J. Pfister
Pur. Agt., Dean E. Foster
Supt., E. W. Mellings, Box 467, Butler, Okla.
Plant in Oklahoma
Capacity, 14,000

Bayliss and Fasenmeyer, Titusville, Pa.
Plant in Pennsylvania
Capacity, 1,000

Bell Bros., Robinson, Ill.
Plants in Illinois
Capacity, 310

Bell Oil & Gas Co., Kennedy Bldg., Tulsa, Okla.
Pres., S. L. Lubell
V. P., Albert Finston
Sec.-Treas., Jesse Finston
Pur. Agt., J. H. Naron
Supt., Rex Young, Grandfield, Okla.
Plants in Texas
Capacity, 10,000

Belridge Oil Co., Edison Bldg., Los Angeles, Calif.
Pres., Burton E. Green
V. P.s, Frank H. Buck, H. L. Westbrook, F. B. Fulton.
Sec., F. B. Sutton
Treas., W. L. Westbrook
Gen. Supt., C. E. Coleston
Pur. Agt., W. C. Wickersham
Plants in California
Capacity, 67,000

Pryor, Berry, Petrolia, Pa.
Plant in Pennsylvania
Capacity, 25

Big Four Oil & Gas Co., Boyd & Watson Sts., Pittsburgh, Pa.
Plant in Illinois
Capacity, 300

Big Lake Oil Co., 223 Fourth Ave., Pittsburgh, Pa.
Pres., J. G. Farquhar
V. P.s, Chas. E. Beyer, W. S. Hallanan
V. P. and Gen. Mgr., A. B. Dally, Jr.
Sec.-Treas., W. E. Huston
Gen. Supt., C. R. Johnson, Texon, Tex.
Pur. Agt., R. E. Johnson
Ch. Chem., J. C. Moore
Ch. Egr., A. G. Stell
Supt., C. C. Hickle, Texon, Tex.
Plant in Texas
Capacity, 50,000

Bolsa Chica Oil Corp., 707 Richfield Bldg., Los Angeles, Calif.
Pres., William Ford
V. P. and Gen. Mgr., C. W. Lord
V. P., S. A. Reed
Sec., E. Ord Slater
Treas., S. A. Reed
Gen. Supt., F. J. Shaver
Pur. Agt., E. C. Ashe
Plants in California
Capacity, 25,000 (shut down)

Brea Canon Oil Co., 831 Standard Oil Bldg., Los Angeles, Calif.
Pres., Dan Murphy
Sec., G. Holterhoff, Jr.
Plant in California
Capacity, 14,000

Breckenridge Gasoline Co., 2313 Madison Ave., Toledo, Ohio
Pres., A. S. Hickok
V. P., Walter G. Kirkbride
Sec.-Treas., C. F. Eisenhour
Gen. Supt., R. L. Ponsler
Plant in Texas
Capacity, 7,000

Brenneman & MacDonnell, 312 South Cole St., Lima, Ohio
Gen. Supt., E. R. Perfect
Plants in Illinois
Capacity, 1,250

C

Calumet Oil Co., 517 I. W. Hellman Bldg., Los Angeles, Calif.
Pres., J. E. Wallis
V. P., T. H. Collins, A. J. McDermott
Sec.-Treas., W. F. Staunton
Gen. Supt., J. C. Armstrong
Plant in California
Capacity, 1,000

Canadian River Gas Co., Colorado Springs, Colo.
Pres., N. K. Moody, Tulsa, Okla.
V. P., P. C. Spencer, A. R. Jones
Sec., A. W. Heinemann
Treas., O. O. Holmgren
Gen. Mgr., Ford, Bacon & Davis, Inc.
Gen Supt., G. A. Woods, Gas Bldg., Amarillo, Tex.
Supt., W. A. Skinner, Gas Bldg., Amarillo, Tex.
Plant in Texas
Capacity, 30,000

Cannon Gasoline Co., Commerce Bldg., Amarillo, Tex.
Pres., J. J. Hastings
V. P., F. J. Storm
Sec., J. B. Dooley
Treas., F. J. Storm
Plant in Texas
Capacity, 5,000

Carbide & Carbon Chemicals Corp., 30 E. Forty-second St., New York City
Pres., J. A. Rafferty
V. P.s, G. O. Crume, Jr., R. W. White, H. E. Thompson, J. W. McLaughlin, J. G. Davidson
Sec., A. C. Cornell
Treas., C. T. Ayers
Sales Mgr., W. F. Reich, Jr.
Gen. Supt., J. M. Topham
Ch. Chem., G. V. Scofield
Pur. Agt., W. F. Ackerman
Ch. Egr., C. S. Dunn
Supts., C. M. Stuter, Hastings, W. Va.; C. E. Center, Diamond, W. Va.
Plants in West Virginia
Capacity, 3,500

Cargray Corp., Amarillo Bldg., Amarillo, Tex.
Pres., Vernon F. Taylor
V. P.s, D. D. Harrington, Stanley Marsh, L. R. Hagy
Sec.-Treas., E. D. Timberlake
Gen. Supt., F. M. Neely
Ch. Chem., W. D. McDonald
Plant in Texas
Capacity, 45,000

Carter Oil Co., National Bank of Tulsa Bldg., Tulsa, Okla.
Pres., C. H. Lieb
V. P., George H. Long
Sec., James A. Veasey
Treas., C. D. Mill
Gen. Supt., G. E. Edgett
Sales Mgr., H. F. Miller
Pur. Agt., J. R. Freedman
Ch. Egr., C. D. Watson
Supts., A. E. Perry, Box 997, Seminole, Okla.; W. T. Mills, Box 787, Wilson, Okla.; F. W. Bruner, Box 7, Carter Nine, Okla.
Plants in Oklahoma
Capacity, 99,000

Casto Oil Co., 318½ Juliana St., Parkersburg, W. Va.
Partnership of Mrs. T. G. Reitz, Elizabeth B. Lansheft, Ira Williams and Ross Wells
Gen. Supt., Ira Williams
Supt., L. O. Alkire, Arvilla, W. Va.
Plant in West Virginia
Capacity, 250

Century Carbon Co., 251 Front St., New York City
Pres., Robert I. Wishnick
V. P.s, J. J. Wheatley, W. S. Schwartz
Sec., D. Tumpeer
Treas., R. I. Wishnick
Gen. Supt., J. J. Wheatley
Pur. Agt., F. F. Dunn, Jr.

Ch. Chem., Melville C. Vaughen
Plants in Louisiana
Capacity, 4,200

Chambers Oil Co., 214 Chambers Bldg., Oil City, Pa.
Plant in Pennsylvania
Capacity, 150

Chemical Oil & Gas Co., Benedum-Trees Bldg., Pittsburgh, Pa.
Pres., M. C. Rodgers
V. P., A. E. May
Sec., George Burgess
Treas., L. L. Beal
Plant in West Virginia
Capacity, 500

Clinger Oil & Gas Co., Tidioute, Pa.
Pres., A. V. Clinger
V. P., George Clinger
Pur. Agt. and Treas., W. F. Clinger
Supts., C. R. Boyd, Truemans, Forest County, Pa.; J. E. Peterson, R.F.D. 3, Tidioute, Pa.
Plants in Pennsylvania
Capacity, 1,000

Clymore Co., Inc., 604 Mixor Bldg., Corpus Christi, Tex.
Pres., Garland Clymore
V. P., W. L. Pearson
Sec.-Treas., Ralph B. Harrison
Gen. Supt., R. S. Wyrick
Pur. Agt., W. L. Pearson
Ch. Chem., V. A. Goss
Ch. Egr., J. R. Wilson
Plant in Texas
Capacity, 30,000

Cockran (John G.) & Co., 676 W. Main St., Sheffield, Pa.
Owner and operator, John G. Cockran
Supt., J. C. Curtin, Barnes, Pa.
Plant in Pennsylvania
Capacity 1,100

C. J. Coffin, Chicora, Pa.
Owner and operator, C. J. Coffin
Supts., C. W. Miller, Route 1, Karns City, Pa.; George Work, Route 2, Chicora, Pa.
Plants in Pennsylvania
Capacity 170

Coline Gasoline Corp., Kerckhoff Bldg., Los Angeles, Calif., or Tradesmen Bank Bldg., Oklahoma City, Okla.
V. P.s, H. L. Briggs, Oklahoma City; F. C. Ripley, Los Angeles, Calif.
Sec., C. W. Sowle, Oklahoma City
Treas., J. W. Price, Oklahoma City.
Supts., Harold Moulton, Kerckhoff Bldg., Los Angeles; L. J. Gude, Oklahoma City
Plants in Oklahoma and California
Capacity, 41,000

Coltexo Corp., Monroe, La.
Pres., F. F. Curtze, Erie, Pa.
V. P., Edwin Bunney, New York City
Sec., Reid L. Carr, New York City
Treas., G. L. Bubb, New York City
Gen. Supt., H. H. Reardon
Sales Mgr., W. H. Anders
Ch. Chem., H. J. Hunter
Ch. Egr., A. T. Givens
Supts., J. P. Cox, Lefors, Tex.; H. E. Means, Lefors, Tex.; W. R. Wise, Lefors, Tex.; E. D. Nolan, Lefors, Tex.; W. E. Reardon
Plants in Texas
Capacity, 100,000

Columbian Gasoline Corp., Monroe, La.
Pres., F. F. Curtze, Erie, Pa.
V. P., Edwin Binney, New York City
Sec., Reid L. Carr, New York City
Treas., George L. Bubb
Gen. Supt., H. H. Reardon
Sales Mgr., W. H. Anders
Ch. Chem., H. T. Hunter
Ch. Egr., A. T. Givens
Supts., W. E. Reardon; R. A. Boyd, Fairbanks, La.; J. S. Dunn, Swartz, La.; J. F. Morris, R.F.D. 2, Bastrop, La.; B. F. Spigenor, Fairbanks La.; R. E. Biggs, R.F.D. 1, Rayville, La.; G. W. Ross, Shamrock, Tex.
Plants in Texas and Louisiana
Capacity, 42,000

Continental Oil Co., Ponca City, Okla.
Pres., D. J. Moran
V. P.s, W. H. Ferguson, W. W. Bruce, E. S. Karstedt
Sec., James J. Cosgrove
Treas., G. F. Smith
Gen. Supt., D. C. Williams
Asst. Supt., J. L. Hale
Sales Mgr., H. J. Kennaday
Pur. Agt., W. H. O'Conner
Ch. Chem., B. H. Lincoln
Ch. Egr., E. O. Bennett
Supts., R. A. Carter, Columbine, Wyo.; A. L. Collins, Burkburnett, Tex. W. W. Rhyne, Wellington, Colo.;
Plants in Oklahoma, Texas, Colorado, Wyoming and New Mexico.
Capacity, 152,200. Six of 10 plants listed operated in conjunction with other companies as shown under respective states.

Consolidated Gasoline Co., 2313 Madison Ave., Toledo, Ohio
Pres., A. S. Hickok
V. P., Walter G. Kirkbride
Sec.-Treas., C. F. Eisenhour
Gen. Supt., R. L. Ponsler, Box 488, Eastland, Tex.
Supt., W. J. Polk, Box 891, Breckenridge, Tex.
Pur. Agt., H. M. Condley, Eastland, Tex.
Plants in Texas
Capacity, 12,000

Cook Oil Lease, Kelletville, Pa.
Owner, E. S. Collins, Portland, Ore.
Mgr., F. R. Klinestiver, Nebraska, Pa.
Sec., James E. Flynn
Ch. Egr., F. Lee Dunkle, Mayburg, Pa.
Plant in Pennsylvania
Capacity, 300

Cowan Oil & Refining Co., Cowan Bldg., Spring St., Los Angeles, Calif.
Pres., John A. Arnold
Sec.-Treas., W. G. Howard
Plant in California
Capacity, 10,000

J. E. Crosbie, Inc., National Bank of Tulsa Bldg., Tulsa, Okla.
Pres., J. E. Crosbie
V. P., W. B. Moran
Sec., M. E. Church
Treas., C. H. Sweet
Pur. Agt. and Gen. Supt., A. W. Dwen
Supts., R. F. Brown, Box 84, Pearson, Okla.; D. B. Young, Box 1795, Holdenville, Okla.; J. Y. Seward, Box 415, Konawa, Okla; S. M. Barrett, Box 425, Okemah, Okla.; E. K. Crosbie, Lovell, Okla.
Plants in Oklahoma
Capacity, 76,000

Crosbie, Porter & Martin, Box 625, Okemah, Okla.
Plant in Oklahoma
Capacity, 20,000

D

Daugherty & Co. (C. R.), Y. M. C. A. Bldg., Butler, Pa.
Mgr., C. R. Daugherty
Plants in Pennsylvania
Capacity, 125

Del Rey Oil & Refining Co., Ltd., 570 Subway Terminal Bldg., Los Angeles, Calif.
Receiver, M. D. Woolery
Gen. Supt., H. V. Hoagland
Plant in California
Capacity, 60,000

Dempseytown Gas Co., 103 Will St., Port Allegany, Pa.
Pres., C. I. Crippen, 30 Broad St., New York City
V. P.s, J. H. Isherwood, Port Allegany, Pa.; G. A. Crosby, 30 Broad St., New York City
Sec., J. C. Forsyth, 30 Broad St., New York City
Treas., C. R. Beddows, 30 Broad St., New York City
Supt., H. K. Dietterick, Knox, Pa.
Plants in Pennsylvania
Capacity, 300

Devonian Oil Co., 1705 National Bank of Tulsa Bldg., Tulsa, Okla.
Pres., J. H. Evans
V. P.s, A. W. Leonard, L. C. Ritts
Sec., G. D. Foster
Supts., E. S. Calvert, Box 57, Overton, Tex.; C. C. Woodson, Box 106, Kelleyville, Okla.
Pur. Agt., H. R. Dean
Plants in Oklahoma
Capacity, 30,000

Dinsmoor & Co., 702 Second St., St. Marys, W. Va.
Pres., J. D. Dinsmoor
V. P., L. E. Dinsmoor
Sec.-Treas., W. P. Kerwood, Jr.
Supt., D. H. Israel, St. Marys, W. Va.
Plant in West Virginia
Capacity, 325

Dunlap, Harry G., Chicora, Pa.
Plant in Pennsylvania
Capacity, 11

E

Eagle-Picher Mining & Smelting Co., 214 West Third St., Joplin, Mo.
Pres., A. E. Bendelari, Cincinnati, Ohio
V. P.s, G. W. Potter, Joplin, Mo.; F. W. Potts, Cincinnati, Ohio
Sec.-Treas., Joseph Hummel, Jr., Cincinnati, Ohio
Gen. Supt., D. C. MacKollor, Picher, Okla.
Supt., W. N. Corbet, Henryetta, Okla.
Plant in Oklahoma
Capacity, 3,000

Eason Oil Co., Bass Bldg., Enid, Okla.
Pres., T. T. Eason
V. P., L. D. Hinman
Sec.-Treas., T. W. Eason
Gen. Supt., A. W. Lindley
Sales Mgr., R. H. Rowland
Pur. Agt., A. C. Hatton
Ch. Chem., G. B. Lyons
Ch. Egr., W. H. Taft
Supts., T. E. Sisk., Box 517, Covington, Okla.; B. T. Weidner, Crescent, Okla.; P. G. Maranville, Enid, Okla.
Plants in Oklahoma
Capacity, 14,000

Edington Gasoline & Refining Co., Inglewood, Calif.
Pres., C. B. Edington
Plant in California
Capacity, 6,000

Eddie O. Edwards., R.F.D. 2, Titusville, Pa.
Plant in Pennsylvania
Capacity, 170

Eiswerth-Hefren & Co., Lucinda, Pa.
Pres., F. M. Baker
V. P., W. J. Ochs
Sec.-Treas., J. F. Eiswerth
Plant in Pennsylvania
Capacity, 400

Ellenberger & Sons (Wm. J.), F.R.D. 1, Karns City, Pa.
Plant in Pennsylvania
Capacity, 300

Elliott Bros., R.F.D. 2, Chicora, Pa.
Plant in Pennsylvania
Capacity, 500

Empire Gas & Fuel Co., Ltd., 80 North Main St., Wellsville, N. Y.
Pres., Harry Bradley
Sec., J. B. Bradley
Treas., George H. Bradley
Gen. Supt., E. C. Harder
Supt., Guy Harder, Andover, N. Y.
Plant in New York
Capacity, 400

Empire Oil & Refining Co., Empire-Masonic Bldg., Bartlesville, Okla.
Pres., H. L. Doherty, 60 Wall St., New York City
V. P.s, F. R. Coates, 60 Wall St., New York City; H. D. Frueauff, 60 Wall St., New York City; W. A. Jones, 60 Wall St., New York City; H. R. Straight, A. W. Ambrose
Sec., C. E. Murray
Treas., R. L. Morton, Jr.
Div. Mgr., E. L. Leck
Supervisors, H. A. Ells, E. L. Stauffacher
Sales Mgr., S. B. Crooks
Pur. Agt., G. A. Tompson
Supts., W. H. Yingling, Arkansas City, Kans.; J. F. Hodge, Tallant, Okla.; R. W. Johnston, Box 2093, Wichita, Kans.; E. Williams, R.F.D. Teter, Hamilton, Kans.; L. A. Webster, Box 188, Madison, Kans.; C. E. Aydelotte, Box 188, Thrall, Kans.; E. R. Estus, Box 395, Seminole, Okla.; P. J. Phillips, R.F.D. 1, Box 600, Seminole, Okla.; C. F. Fischer, Box 1205, Seminole, Okla.; J. A. Dowler, Box 1638, Konawa, Okla.; W. H. Tillock, R.F.D. 2, Wanette, Okla.; V. F. Hobart, Box 1686, Pampa, Tex.
Plants in Oklahoma, Kansas and Texas
Capacity 240,500

Enfisco Oil Corp., Box 2021, Tulsa, Okla.
Pres., Edward N. Fisher
V. P.s, S. S. Smith, J. F. Dittman
Sec., M. Jerome
Treas., L. J. Margulies
Plant in Oklahoma
Capacity 1,500

Equitable Gas Co., 435 Sixth Ave., Pittsburgh, Pa.
Pres., F. R. Phillips
V. P., F. F. Schauer
V. P. Chg. Sales, Joseph McKinley
Gen. Supt., Judson Bonsall
Sec., W. B. Carson
Treas., C. J. Braun, Jr.
Oper. Mgr., D. P. Hartson
Pur. Agt., C. W. Lepper
Supts., G. M. Myers, Rogersville, Pa.; P. E. Jackson, R.F.D. 1, Clarksville, Pa.
Plants in Pennsylvania
Capacity, 8,000

Excelsior Refining Co., Inc., P. O. Box 208, Shreveport, La.
Pres., J. B. Atkins
V. P., D. P. Hamilton
Asst. Sec., R. A. Worley
Gen. Supt., E. L. Clover
Sales Mgr., J. B. Atkins
Pur. Agt., R. A. Worley
Ch. Chem., R. R. Hartnett
Supt., E. L. Clover, P. O. Box 456, Henderson, Tex.
Plant in Texas
Capacity, 20,000

F

Field Gasoline Corp. (O. C.), 609 Board of Trade Bldg., Los Angeles, Calif.
Pres., O. C. Field
V. P.s, W. G. Metson, J. C. Burks
Sec., N. J. Hale
Treas., R. B. Hale
Gen. Mgr. and Pur. Agt., J. C. Burks
Supts., A. L. Henrickson, Box 211, Huntington Beach, Calif.; I. H. Westmoreland, Box 832, Maricopa, Calif.
Plants in California
Capacity, 40,000

Fleming, J. E., Box 606, Titusville, Pa.
Owner, J. E. Fleming
Supt., B. H. Crippen, Grand Valley, Warren County, Pa.
Plant in Pennsylvania.
Capacity, 500

Forest Chemical Co., Sheffield, Pa.
Pres., Charles R. McNeal
V. P., Charles F. McNeal
Plant in Pennsylvania
Capacity, 500

Fullerton Oil Co., R.F.D. 1, Box 456, Fullerton, Calif.
Pres., W. L. Valentine
V. P., W. F. Ball
Sec., V. T. Severns
Treas., W. L. Valentine
Gen. Supt., E. H. Adams
Plant in California
Capacity, 6,000

G

General Petroleum Corp. of California, Higgins Bldg., Los Angeles, Calif.
Pres., A. L. Weil
V. P.s, R. A. Sperry, S. J. Dickey, W. L. McLaine, A. H. DeFriest
Sec., D. W. Woods
Treas., W. Cunningham
Mgr., R. C. Wheeler
Sales Mgr., A. H. DeFriest
Pur. Agt., R. M. Ketchum
Ch. Chem., G. F. Olsen
Ch. Egr., V. F. Grace
Supts., J. L. McMahon, Santa Fe Springs, Calif.; J. W. Scott, 124 Avalon Blvd., Los Angeles, Calif.; H. W. Havins, Box P-1, Ventura, Calif.; H. S. Donovan, Lebec, Calif.;

E. P. Donahue, R.F.D. 1, Box 466, Fullerton, Calif.
Plants in California
Capacity, 265,000

Getty Gasoline Co. (George F.), 1060 Subway Terminal Bldg., Los Angeles, Calif.
Pres., E. Kluth
V. P., H. M. Macomber
Sec., S. E. Cavanaugh
Treas., Firo Williams
Gen. Supt., B. A. Koehler
Ch. Egr., W. F. Crane
Supt., J. J. Murphy, Box 827, Santa Fe Springs, Calif.
Plant in California
Capacity, 10,000

Gilmore Gasoline Plant No. 1, 2423 East Twenty-eighth St., Los Angeles, Calif.
Pres., E. B. Gilmore
Sec.-Treas., C. S. Beesmyer
Gen. Supt., H. C. Eggleston
Sales Mgr., J. L. Coates
Pur. Agt., L. K. Snyder
Supt., W. Shellshear, 2140 Walnut Ave., Long Beach, Calif.
Plant in California
Capacity, 30,000

Gilmore-Dabney Gasoline Corp., 2423 East Twenty-eighth St., Los Angeles, Calif.
Pres., E. B. Gilmore
V. P., Milton H. Philler
Sec.-Treas., C. S. Beesmyer
Gen. Supt., H. C. Eggleston
Sales Mgr., J. L. Coates
Pur. Agt., L. K. Snyder
Supt., W. Shellshear, 2140 Walnut Ave., Long Beach, Calif.
Plant in California
Capacity, 90,000

Gladewater Gasoline Co., Gladewater, Tex.
Pres., C. R. Starnes
Sec.-Treas., E. L. Ames
Gen. Supt., W. G. Manes
Sales Mgr., A. C. Taylor
Plants in Texas
Capacity, 16,000

Gould & Son (Nancy E.), R.F.D. 6, Butler, Pa.
Gen. Supt., F. B. Gould
Plant in Pennsylvania
Capacity, 6

Graham Oil & Gas Co., Graham, Tex.
Pres., Philip Wiseman
V. P.s, H. S. Mudd, L. W. Wickes
Sec.-Treas., G. R. Paull
Gen. Supt., G. R. Paull
Ch. Egr., E. R. Marchman
Sales Mgr., W. H. Anders
Plant in Texas
Capacity, 8,000

Grimes (Otha H.) and Roy O. Neal, Atlas Life Bldg., Tulsa, Okla.
Gen. Supt., Harry Miller
Sales Mgr., Otha H. Grimes
Pur. Agt., Roy O. Neal
Supt., Harry Miller, Box 513, Drumright, Okla.
Plant in Oklahoma
Capacity, 3,400

Grimes Gasoline Co. (including plants of C. W. and Otha H. Grimes; Otha H. and Philo W. Grimes; Park T. and Oscar L. Grimes), 903 Kennedy Bldg., Tulsa, Okla.
Pres., Charles W. Grimes
Sec.-Treas., Otha H. Grimes
Supts., J. D. McQuillen, Okemah, Okla.; Joe Gibson, Weleetka, Okla.; H. B. Trickey, Weleetka, Okla.; John Elliott, Keystone, Okla.; L. C. Crupper, Mannford, Okla.
Plants in Oklahoma
Capacity, 18,000

Gulf Production Co., Fort Worth, Tex.
Gen. Supt., W. H. Vaughn
Supt., J. H. Eubank, P. O. Box 88, Breckenridge, Tex.
Plant in Texas
Capacity, 10,600

Gulf Refining Co. of Louisiana, Gulf Bldg., Pittsburgh, Pa.
Chm. of Board, J. F. Drake
Pres., F. A. Leovy
V. P.s, Underwood Nazro, C. R. Minor
Sec., W. J. Guthrie
Treas., J. E. Nelson
Asst. Sec., L. E. Delcuze
Asst. Treas., C. H. Stevens
Plants in Louisiana and Arkansas
Capacity, 22,000

Gypsy Oil Co., First National Bank Bldg., Tulsa, Okla.
V. P., Rush Greenslade
Asst. Sec., D. B. Catterlin
Asst. Treas., C. B. Clothier
Gen. Supt., S. G. Sanderson
Pur. Agt., V. C. Fuller
Supts., J. J. Donovan, Box 368, Kiefer, Okla.; W. L. McCormick, Route 2, Kaw City, Okla.; Frank Routh, Box 967, Seminole, Okla.
Plants in Oklahoma
Capacity, 62,200

H

Haddon, James B., Sheffield, Pa.
Plant in Pennsylvania
Capacity, 84

Hanlon Gasoline Co., 718 National Bank of Tulsa Bldg., Tulsa, Okla.
Pres., E. I. Hanlon
V. P.s, J. H. Boyle, D. E. Buchanan
Sec., L. C. Holloway
Treas., J. H. Boyle
Sales Mgr., Ray Miller
Pur. Agt., J. H. Boyle
Ch. Chem., C. E. Benham
Ch. Egr., C. E. Wharton
Gen. Supt., C. E. Wharton
Supt., A. A. Hardee, Breckenridge, Tex.
Plants in Texas
Capacity, 50,000

Hanlon-Buchanan, Inc., 718 National Bank of Tulsa Bldg., Tulsa, Okla.
Chm. of Board, E. I. Hanlon
Pres., D. E. Buchanan
Sec.-Treas., J. H. Boyle
Plant in Texas
Capacity, 35,000

Hapgood & Co. (R. T.), 705 Security Bank & Trust Bldg., Charleston, W. Va.
Owner, R. T. Hapgood
Gen. Supt., D. T. McClure
Supts., Wiley Price, Cedar Grove, W. Va.; D. T. McClure, Charleston, W. Va.
Plants in West Virginia
Capacity, 3,500

Harland Oil Co., Wolco, Osage County, Okla.; P. O. Drawer A
Pres., W. W. Vensel
V. P., T. S. Loffland
Sec., H. W. Vensel
Treas., J. M. Loffland
Gen. Supt. and Pur. Agt., H. B. Zahniser
Ch. Egrs., D. C. Bohnsack, Wolco; E. W. Vensel, Barnsdall
Plants in Oklahoma
Capacity, 3,000

Harmony Gasoline Corp., Ardis Bldg., Shreveport, La.
Pres., E. R. Ratcliff
V. P., D. W. Harris
Sec., T. J. Heard
Treas., B. R. Muirhead
Gen. Supt., A. H. Weyland
Pur. Agt., J. Lucas
Ch. Egr., H. T. Goss
Supt. Gaso. Div., E. P. Farmer
Supt., T. T. Gordon, Box 1659, Longview, Tex.
Plant in Texas
Capacity, 15,000

Haskell Brothers, Pleasantville, Pa.
Supt., William A. Haskell
Plants in Pennsylvania
Capacity, 450

Haskell & Dunham, Pleasantville, Pa.
Plant in Pennsylvania
Capacity, 100

Haskell, Roth & Bayliss, Titusville, Pa.
Sec., George Bayliss
Supt., Charles E. Myers, Tidioute, Pa.
Plant in Pennsylvania
Capacity, 300

Henderson Co., 818 McBirney Bldg., Tulsa, Okla.
Pres., F. C. Henderson
V. P., J. Wood Glass
Sec., F. C. Hall
Treas., E. P. Henderson
Ch. Egr., C. C. Cherry
Pur. Agt., F. C. Hall
Supts., C. C. Cherry, El Dorado, Ark.; C. A. Seiple, Sanford, Tex.
Plants in Arkansas and Texas
Capacity, 31,000

Herkness (J. S.), Tenth and Lombard Sts., Philadelphia, Pa.
Pres., J. S. Herkness
Gen. Supt., A. J. Flint
Plant in Louisiana
Capacity, 1,000

Hickey & Rieg, Clarendon, Pa.
Plant in Pennsylvania
Capacity, 300

Highway Gasoline Co. (See Bolsa Chica Oil Corp., parent company)

Home Gas Co., 604 Main St., Clarion, Pa.
Pres., E. H. Banner
V. P., H. H. Arnold
Sec., M. M. Kaufman
Gen. Supt., A. J. McCleary
Pur. Agt., Abe Kaufman
Plant in Pennsylvania

Honolulu Oil Corp., Ltd., 215 Market St., San Francisco, Calif.
Pres., A. C. Dieriex
V. P.s, A. C. Mattei, W. M. Alexander, C. E. Green, A. P. Welch, W. P. Roth
Sec., L. A. Cranson
Treas., W. P. Roth
Gen. Supt., R. R. McGuire
Pur. Agt., O. E. Cunningham
Ch. Chem., W. H. Kraft
Supt., H. S. Stark, Bin H, Taft, Calif.
Plants in California
Capacity, 60,000

Hope Construction & Refining Co., 545 William Penn Way, Pittsburgh, Pa.
Pres., H. C. Cooper
V. P.s, L. L. Tonkin, J. B. Tonkin
Sec., S. E. W. Burnside
Treas., J. C. Chisler
Gen. Supt., W. B. Gribble
Pur. Agt., F. O. LeRoy
Ch. Egr., L. L. Tonkin
Ch. Chem., R. W. Miller
Plants in West Virginia, Ohio and Pennsylvania
Capacity, 127,700

Huber Co. (J. M.), of Louisiana, Inc., Box 278, Borger, Tex.
Pres., J. M. Huber
V. P., H. W. Huber
Sec.-Treas., Walter Huber
Sales Mgr., R. H. Eagles
Plant in Louisiana
Capacity, 6,000

Huber Petroleum Co. (J. M.), Box 278, Borger, Tex.
Pres., Walter David
V. P.-Sec., W. H. Price
Treas., H. W. Huber
Supt., C. B. Rose
Plant in Texas
Capacity, 20,000

Humble Oil & Refining Co., Humble Bldg., Houston, Tex.
Pres., R. L. Blaffer
V. P.s, H. C. Wiess, James Anderson, Wallace E. Pratt, John R. Suman, Judge E. E. Townes
Sec., F. A. Freese
Treas., R. L. Blaffer
Gen. Supt., R. S. Clark
Sales Mgr., B. H. Brown
Pur. Agt., J. M. Sitler
Ch. Egr., C. M. Gibble
Supts., W. B. Calhoun, Overton, Tex.; G. L. McCormick, Rising Star, Tex.; R. W. Way, Bellville, Tex.; R. E. Buckner, Iraan, Tex.; J. R. Carroll, Conroe, Tex.
Plants in Texas
Capacity, 113,500

Hunter, Livingston L., Trust, Tidioute, Pa.
Plant in Pennsylvania
Capacity, 300 (shut down)

I

Imperial Oil & Gas Products Co., Union Bank Bldg., Pittsburgh, Pa.
Pres., Joseph Hartman
V. P.s, Paul A. Hartman, Joseph W. Hartman
Sec.-Treas., W. P. McNellie
Sales Mgr. and Pur. Agt., Paul A. Hartman
Supt., J. C. Westfall, P. O. Box 749, El Dorado, Ark.
Plant in Arkansas
Capacity 500

Indian Territory Illuminating Oil Co., Drawer L, Bartlesville, Okla.
Pres., H. V. Foster
V. P.s, Burdette Blue, H. O. Caster, F. R. Coates, W. A. Jones, C. H. Caldwell, R. L. Gordon, A. V. Hoenig
Sec., E. B. Emenhiser
Treas., C. H. Caldwell
Gen. Supt., T. A. Stevens
Sales Mgr., G. V. N. Yates
Pur. Agt., A. M. Butcher
Ch. Chem, Dana Hefley
Pur. Agt., H. D. Partridge
Supts., James Porter, Box 4577, Capitol Hill, Oklahoma City, Okla.; Paul Shunkey, Box 4577, Capitol Hill, Oklahoma City, Okla.; C. D. McReynolds, Box 4577, Capitol Hill, Oklahoma City, Okla.; H. P. Wingo, Box 4577, Capitol Hill, Oklahoma City Okla.
Plants in Oklahoma
Capacity, 150,000

International Oil & Gas Co., Washington, Pa.
Plant in Illinois
Capacity, 2,000

J

Jackson, Fred W., Chicora, Pa.
Plant in Pennsylvania
Capacity, 360

Jennings Brothers Co. (E. H.), 608 Columbia Bldg., Pittsburgh, Pa.
Pres., R. G. Jennings
V. P., E. D. Jennings
Sec., E. H. Jennings
Treas., R. G. Jennings
Plants in Pennsylvania
Capacity, 2,350

K

Kanawha Oil Co., 608 Columbia Bldg., Pittsburgh, Pa.
Plants in West Virginia

Kansas Gasoline Co., 1504 National Bank of Tulsa Bldg., Tulsa, Okla.
Pres., J. A. Hull
V. P., R. C. Riley
Sec., O. J. McCann
Treas. and Pur. Agt., P. F. Cole
Gen. Supt., J. L. Looney
Ch. Egr., W. A. Melton
Supt., J. L. Looney, Box 1007, Winfield, Kans.
Plant in Kansas
Capacity, 5,000

Kansas Gas & Gasoline Co., Union Life Bldg., Salina, Kans.
Pres., C. A. Leland, care of Des Moines Gas Co., Des Moines, Iowa
V. P.s, H. L. Hanley, care of Illinois Power & Light Co., Chicago, Ill.; L. E. Fischer, care of Illinois Power & Light Co., Chicago, Ill.
Sec., D. H. Holmes, care of Illinois Power & Light Co., Chicago, Ill.
Treas., A. J. Berta, care of Illinois Power & Light Co., Chicago, Ill.
Pur. Agt., O. E. Snyder, 740 Board of Trade Bldg., Kansas City, Mo.
Ch. Chem., R. B. McLaughlin
Ch. Egr., W. J. White
Supts., J. C. Porter, McPherson, Kans.; R. B. McLaughlin, Medicine Lodge, Kans.
Sale of products handled through Altitude Petroleum Co.
Plants in Kansas
Capacity, 26,000

Kennedy Co., Bradford, Pa.
Plant in Pennsylvania
Capacity, 235

Kentucky Pipe Line Co., 311 West Chestnut St., Louisville, Ky.
Pres., T. B. Wilson
V. P.s, J. J. McKenna, A. W. Lee, R. Montgomery
Sec., F. J. Pfeiffer
Treas., J. J. McKenna

Gen. Supt. and Sales Mgr., J. A. Yunker
Pur. Agt., G. Davies
Supt., H. D. Robb, Winchester, Ky.
Plant in Kentucky
Capacity, 2,600

Kewanee Oil & Gas Co., 2317 Fidelity-Philadelphia Trust Bldg., Philadelphia, Pa.
Pres., Wm. M. Potts
Sec. and Treas., R. B. Ashenfelter
Gen. Supt., F. B. Howland
Supt., T. B. Steele, P. O. Box 232, Robinson, Ill.
Plants in Illinois
Capacity, 485

L

LaSalle Petroleum Co., 612 Wright Bldg., Tulsa, Okla.
Receivers, W. J. Schnur and Phil D. Williams
Supt., Phil D. Williams, P. O. Box 576 Burkburnett, Tex.
Plant in Texas
Capacity, 8,000 (Shut Down)

Lebow (C. H.), 509 Atlas Life Bldg., Tulsa, Okla.
Gen. Supt., Vern Smith
Pur. Agt., Roy O. Neal
Supt., Vern Smith, Box 86, Drumright, Okla.
Plant in Oklahoma
Capacity, 1,600

Lisbon Gasoline Co., Inc., 211 Ardis Bldg., Shreveport, La.
Pres., O. J. Dykes
V. P., Geo. W. James
Sec., T. J. Heard
Treas., D. R. Muirhead
Gen. Supt., M. H. Trout, Box 464, Henderson, Tex.
Plants in Texas and Arkansas
Capacity, 15,000

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Capacity, 40,000

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Capacity, 87,000

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Capacity, 40,000

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Capacity, 2,500

M

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Treas., L. B. Niehoff
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Pur. Agt., Alex U. McCandless
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Pur. Agt., A. H. Purdy
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Sec. and Treas., Burton French
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Shut down

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N

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Plants in Oklahoma
Capacity, 4,500

Powers & Quinlan, 624 So. Cheyenne Ave., Tulsa, Okla.
Partnership, M. F. Powers and Felix Quinlan, Jr.
Gen. Supt., Felix Quinlan
Sales Mgr., E. C. Sager
Pur. Agt., G. A. Keefe
Supt., Felix Quinlan, Beggs, Okla.
Plants in Oklahoma
Capacity, 2,000

President Oil Co., Emlenton, Pa.
Pres., H. J. Crawford
Sec. and Treas., J. E. Taylor
Supts., J. S. Beals, Emlenton, Pa.; S. Smith, Venus, Pa.
Plants in Pennsylvania
Capacity, 750

Preston Oil Co., 99 North Front St., Columbus, Ohio
Pres., C. I. Weaver
V. P.s, T. H. Kerr, T. B. Gregory and W. L. McCloy
Sec., P. A. Alberty
Treas., E. D. Bivens
Gen. Supt., George T. Koch
Sales Mgr., R. M. Clark
Pur. Agt., G. R. Miller
Ch. Chem., R. J. Schuster
Supts., E. L. Hyatt, Medina, Ohio; L. B. Myers, Homer, Ohio; H. R. Hyatt, Pavonia, Ohio; W. B. Wonderly, Sugar Grove, Ohio; P. A. Ross, R. F. D. 2, Summerfield, Ohio; Earl Scott, R. F. D. 1, Racine, Ohio
Plants in Ohio
Capacity, 198,000

Pure Oil Co., 35 East Wacker Drive, Chicago, Ill.
Pres., H. M. Dawes
V. P.s, W. E. Hutton, R. W. McIlvain, C. B. Watson, N. H. Weber, L. S. Wescoat, F. S. Heath and Rawleigh Warner
Sec., L. S. Wescoat
Treas., Rawleigh Warner
Sales Mgr., R. H. McElroy
Pur. Agt., G. L. Parsons
Ch. Chem., R. C. Osterstrom
Ch. Egr., D. E. Sullivan
Supts., W. L. McCarty, Box 1277, Drumright, Okla.; J. H. Prater, Box 224, Van, Tex.; W. R. Waggoner, Box 87, Daws, W. Va.
Plants in Oklahoma, West Virginia and Texas
Capacity, 59,950

R

Rainbow Gasoline Corp., 818 McBirney Bldg., Tulsa, Okla.
Pres., D. S. Brooks
V. P., M. D. Brooks
Sec., F. C. Hall
Treas., F. C. Henderson
Sales Mgr. and Pur. Agt., F. C. Hall
Gen Supt., C. C. Cherry
Ch. Egr., O. H. Stanbrough
Plant in Arkansas
Capacity, 20,000

Ramage, S. Y., 6 First Nat'l Bank Bldg., Oil City, Pa.
Supts., Fred McDaniels, Reno, Pa.; F. J. Swanson, R.F.D., Tidioute, Pa.; Clarence Dearth, Bens Run, W. Va. Dearth, Bens Run, W. Va.
Plants in Pennsylvania

Red Brush Oil Co., 10 Walnut St., Tidioute, Pa.
Sec. and Treas., C. E. Gesin
Supt., C. E. Gesin, Tidioute, Pa.
Plant in Pennsylvania
Capacity, 40

Reno Oil Co., Wells Bldg., Sisterville, W. Va.
Pres., J. P. Flynn
Sec. and Treas., W. R. Reitz
Gen. Supt. and Pur. Agt., J. P. Flynn
Supts., A. C. Mercer, Ellenboro, W. Va.; John McGuirk, R. F. D., Harrisville, W. Va.; Otto Woodburn and S. G. Hissam, R. F. D., Sistersville, W. Va.
Plants in West Virginia
Capacity, 252

Reservoir Hill Gasoline Co., 417 So. Hill St., Los Angeles, Calif.
Exec. V. P., Frank A. Morgan
V. P., Frank A. Morgan
Sec. and Treas., M. R. Gross
Supt., R. E. Wells
Pur. Agt., H. H. Kelly
Sales Mgr., A. H. Harris
Plant in California
Capacity, 12,000

Reserve Gas Co., 545 Wm. Penn Way, Pittsburgh, Pa.
Pres., J. B. Tonkin
V. P., T. B. Gregory
Sec., S. E. W. Burnside
Treas., J. C. Chisler
Gen. Supt., W. B. Gribble
Pur. Agt., F. O. LeRoy
Ch. Chem., R. W. Miller
Ch. Egr., L. L. Tonkin
Supt., John Campbell, Valley Chapel, W. Va.
Plant in West Virginia
Capacity, 20,000

Reserve Development Co., Philtower Bldg., Tulsa, Okla.
Pres., Fred Phillips
V. P.s, W. M. Irish III, W. F. Maxwell
Sec., Hunter L. Johnson
Treas., W. F. Maxwell
Pur. Agt., E. L. Henry
Supt., H. L. Morgan, Box 9, Louann, Ark.
Plants in Arkansas
Capacity, 5,000

Rice Ranch Oil Co., 262 So. Los Angeles St., Los Angeles, Calif.
Pres., G. W. Lichtenberger
V. P.s, Alfred J. Bayer and P. H. O'Neil
Sec., H. G. Phillips
Gen. Supt., Edgar Craig
Plant in California
Capacity, 6,000

Riddle Farm Oil Co., Karns City, Pa.
Plant in Pennsylvania
Capacity, 50

Rio Grande Oil Co., 417 So. Hill St., Los Angeles, Calif.
Exec. V. P., C. S. Jones
V. P., Frank A. Morgan
Sec. and Treas., M. R. Gross
Sales Mgr., A. H. Harris
Supt., R. E. Wells
Pur. Agt., H. H. Kelly
Plants in California
Capacity, 10,000

Roeser & Pendleton, Inc., 613 Fort Worth Club Bldg., Fort Worth, Tex.
Pres., Charles F. Roeser
V. P.s, T. T. Pendleton, M. R. Young
Sec. and Treas., H. B. Owens
Gen. Supt., G. P. Crutchfield, Albany, Tex.
Supt., C. A. Davis, Albany, Tex.
Plant in Texas
Capacity, 25,000

Rogers (R. G.), Oil Co., Oblong, Ill.
Plant in Illinois
Capacity, 35

Ryan & Hackett Co., Inc., 623 Taft Bldg., Los Angeles, Calif.
Pres., G. P. Ryan
V. P., H. A. Hackett
Sec. and Treas., J. H. Haring
Plant in California
Capacity, 3,000

S

Sand Hill Lease, Tidioute, Pa.
Partnership
Supt., Alfred Peterson, R. F. D. 3, Tidioute, Pa.
Plant in Pennsylvania
Capacity, 100

St. Helens Petroleum Co., Ltd., Los Angeles, Calif.
Chm. of Board, C. B. Stocken
Dirs., William Ivey, A. F. Strickland
Gen. Mgr., Charles Drader
Sec., R. H. Young
Gen. Supt., C. Z. Webb
Sales Mgr., C. N. Collins
Pur. Agt., W. C. Cowie
Ch. Chem., C. W. Spark
Ch. Egr., C. Z. Webb
Supts., C. Z. Webb, Box D, Pico, Calif.; Geo. C. Sproule, Box 248, Montebello, Calif.; J. A. Stotts, Box M, Taft, Calif.
Plants in California
Capacity, 3,250

Shamrock Oil & Gas Co., Amarillo Bldg., Amarillo, Tex.
Pres., J. J. Sheerin
V. P., H. C. Fownes II
Sec., W. E. Motheral
Treas., J. B. Orr
Gen. Supt., E. C. Will
Ch. Chem., J. B. Orr, Jr.
Supt., E. C. Will, P. O. Box 1076, Pampa, Tex.
Plant in Texas
Capacity, 15,000

Shell Oil Co., 200 Bush St., San Francisco, Calif.
Pres., C. Legh-Jones
Sec., A. R. Bradley
Treas., John Lander
Pur. Agt., J. S. Story
Plants in California
Capacity, 256,000

Shell Petroleum Corp., Shell Bldg., St. Louis, Mo.
Pres., Alexander Fraser
V. P.s, Richard Airey, H. H. Anderson, J. W. Watson, Dr. W. Van Holst Pellekaan, G. S. Rollin, L. van Eeghen, T. E. Swigart, R. P. Bascom and J. F. Taylor
Sec., P. R. Chenoweth
Treas., J. W. Watson
Gen. Supt., S. S. Smith, Mayo Bldg., Tulsa, Okla.
Sales Mgr., L. van Eeghen
Pur. Agt., C. B. Singleton
Supts., M. R. Church, Braman, Okla.; J. L. May, Hobbs, N. Mex.; E. H. Ross, Drumright, Okla.; C. E. Haines, Pampa, Tex.; L. L. Lamar, Oxford, Kans.; C. E. Smith, Marshall, Okla.; E. F. Thoes, Maud, Okla.; S. W. Craig, Three Sands, Okla.
Plants in Oklahoma, Kansas, Texas and New Mexico
Capacity, 113,000

Signal Gasoline Co. of Texas, 811 West 7th St., Los Angeles, Calif.
Pres., S. B. Mosher
V. P.s, R. H. Green, O. W. March
Sec., H. J. March
Treas., O. W. March
Gen. Supt., R. W. Heath
Sales Mgr., O. W. March
Pur. Agt., J. F. Thies
Ch. Egr., G. L. Young
Plant in Texas
Capacity, 50,000

Signal Hill Gasoline Co., 555 South Flower St., Los Angeles, Calif.
Pres., R. W. Walsh
V. P.s, A. M. Kelly, J. S. Wallace, R. D. Montgomery
Sec. and Treas., B. B. Wilson
Gen. Mgr., H. R. Linhoff
Ch. Chem., M. L. Arnold
Pur. Agt., B. J. Mahaffy
Supts., M. D. Martin, Box K, Taft, Calif.; C. E. Gotterba, Bin "W", Long Beach, Calif.
Plants in California
Capacity, 85,000

Signal Oil & Gas Co., 811 West 7th St., Los Angeles, Calif.
Pres., S. B. Mosher
V. P.s, R. H. Green, O. W. March
Sec., H. J. March
Treas., O. W. March
Gen. Supt., R. W. Heath
Sales Mgr., O. W. March
Pur. Agt., J. F. Thies
Ch. Egr., G. L. Young
Supts., J. G. Hill, Long Beach, Calif.; A. Kittleberger, Long Beach, Calif.
Plant in California
Capacity, 85,000

Silurian Oil Co., Missouri Pacific Bldg., St. Louis, Mo.
Pres., B. O. Mahaffey
V. P., C. F. Buchner
Sec. and Treas., E. R. Christman
Gen. Supt., Dee Miller
Ch. Egr., R. E. Hilpert
Supts., J. B. Crisman, Tulsa, Okla.; E. O. Bishop, Avant, Okla.
Plant in Oklahoma
Capacity, 1,200

Sinclair Oil & Gas Co., Sinclair Bldg., Tulsa, Okla.
Pres., H. L. Phillips
V. P., W. W. Baker
Sec. and Treas., A. E. Barrus
Asst. Treas., H. M. Coulson
Gen. Supt., C. L. Brown
Sales Mgr., A. T. Scherer
Pur. Agt., H. A. Woodard
Ch. Chem., J. L. Gallagher
Ch. Egr., E. A. Wooden
Supts., Lewis Snyder, P. O. Box 68, Cleveland, Okla.; G. H. Youker, R. F. D. 1, Drumright, Okla.; W. D. Dolan, Box 578, Shamrock, Okla.; B. C. Sharrett, Box 368, Covington, Okla.; L. M. Kelsey, Box 6, Shidler, Okla.; L. N. Yates, Box E, Kenbro, Kans.; F. B. Pearce, Box 865, Seminole, Okla.; L. F. Knuland, Box 787, Seminole, Okla.; L. C. Van Cleave, Box 4188, Oklahoma City, Okla.; K. R. Elliott, Box 80, St. Louis, Okla.; C. J. Tighe, Box 1674, Longview, Tex.; V. H. Akers, Box 297, Sasakwa, Okla.
Plants in Oklahoma, Kansas and Texas
Capacity, 322,000

Skelly Oil Co., Fourth & Boulder, Tulsa, Okla.
Pres., W. G. Skelly
V. P.s, C. C. Herndon, H. M. Stalcup, R. T. Lyons, W. T. Atkins.
Sec. and Treas., F. T. Hopp
Sales Mgr., W. T. Atkins
Pur. Agt., F. W. Robertson
Supts., E. K. Anderson, Box 157, Lyman, Okla.; L. Barrett, Box 536, Seminole, Okla.; A. H. Bazell, Box 816, Burkburnett, Tex.; J. E. Carlson, Box 127, Skellytown, Tex.; M. S. Pike, Box 336, Whittenburg, Tex.; C. H. Smith, Box 413, Wynona, Okla.; C. A. Holmes, Box 168, Slick, Okla.; G. E. Canady, Box 27, Skellytown, Tex.; C. P. Duvall, Box 236, Cunningham, Kans.; J. T. Crawford, Box 36, Route 2, Jennings, Okla.
Plants in Oklahoma, Texas and Kansas
Capacity, 103,250

Sloan & Zook Co., 101 Main St., Bradford, Pa.
Pres., R. T. Zook
V. P., W. J. Sloan
Sec., C. T. Rickerson
Treas., W. J. Sloan
Gen. Supt. and Sales Mgr., Paul H. Zook, Kane, Pa.
Pur. Agt., Wm. B. Vernon
Supt., I. J. Johnson, Kane, Pa.
Plant in Pennsylvania
Capacity, 1,500

Smith Brothers Refining Co., McLean, Tex.
Pres., Vester Smith
V. P., Porter Smith
Sec. and Treas., P. J. Coffey
Plant in Texas
Capacity, 40,000

Snowden & McSweeney Co., 598 Madison Ave., New York City
Pres., H. McSweeney
V. P., J. P. Shannon
Sec., Pearl M. Snowden
Treas., Marie H. Wright
Gen. Supt., A. E. Baldwin
Supt., A. E. Baldwin, Bridgeport, Ill.
Plant in Illinois
Capacity, 1,000

South Penn Oil Co., Chamber of Commerce Bldg., Pittsburgh, Pa.
Pres., P. H. Curry
V. P.s, F. J. Huffman, C. B. Turner
Sec., John L. Hays
Treas., S. G. Hartman
Pur. Agt., E. W. Kartlick
Gen. Mgr., C. F. Stevenson
Ch. Chem. and Egr., H. L. Little
Plants in West Virginia and Pennsylvania
Capacity, 25,000

South Plains Pipe Line Co., Lubbock, Tex.
Pres., A. R. Jones
V. P.s, George Beard and L. R. Crawford
V. P. and Gen. Mgr., C. R. Miner
Sec., A. W. Heinemann
Treas., O. O. Holmgren
Pur. Agt., H. E. Kimbell
Supt., J. S. Le Gate, Box 1443, Amarillo, Tex.
Plant in Texas
Capacity, 35,000

Southern Oil Co., 1005 Farmers Bank Bldg., Pittsburgh, Pa.
Pres., E. B. Reeser, Box 2091, Tulsa, Okla.
V. P. and Sec., Jas. A. Dunn, 120 Broadway, New York City
Treas., L. D. Messner, Box 2033, Tulsa, Okla.
Pur. Agt., F. H. McQuiston
Supts., C. R. Jeannerat, Third St., Clarion, Pa.; C. A. Cousten, Middlebourne, W. Va.; Arthur Cousten, Macfarlan, W. Va.; V. P. Stover, Sycamore Valley, Ohio; R. A. Bookman, Schley, Ohio.
Plants in Pennsylvania, West Virginia and Ohio
Capacity, 2,875

Southland Gasoline Co., 417 West 6th St., Tulsa, Okla.
Pres., B. J. Arbon
V. P., H. M. Preston
Sec. and Treas., B. J. Arbon
Plant in Oklahoma
Capacity, 2,000

Southwest Production Co., 123½ W. 7th St., Bristow, Okla.
Pres., E. A. Feldtkeller
V. P., A. W. Conover
Sec. and Treas., C. D. Perry
Gen. Supt., A. W. Conover
Ch. Egr., A. C. Wright
Supt., A. C. Wright, Box 68, Bristow, Okla.
Plant in Oklahoma
Capacity, 2,000

Standard Gasoline Co., 225 Bush St., San Francisco, Calif.
Pres., K. R. Kingsbury
V. P.s, W. H. Berg, R. W. Hanna, A. S. Russell
Sec., J. H. Tuttle
Treas., V. F. Palmer
Plants in California
Capacity, 968,930

Standard Oil Co. of Louisiana, New Orleans, La.
Pres., J. C. Hilton
V. P.s, A. K. Gordon, H. H. Hewetson, J. E. Skehan
Gen. Mgr., W. L. Stratton, Shreveport, La.
Gen. Supt., R. A. Howe, Shreveport, La.
Plants in Louisiana and Arkansas
Capacity, 33,650

Stanolind Oil & Gas Co., Philcade Bldg., Tulsa, Okla.
Pres., F. O. Prior
V. P.s, A. M. McCorkle, E. F. Bullard and G. H. Jaques
Sec. and Treas., F. J. Keleher
Gen. Supt., H. W. Klein
Pur. Agt., W. L. James
Ch. Egr., G. S. Bays
Ch. Chem., O. W. White
Supts., E. J. Goldman, Drumright, Okla.; H. U. Jarrett, Tonkawa, Okla.; R. W. Davis, Gilliam, La.; A. C. Anders, Midwest, Wyo.
Plants in Oklahoma, Louisiana and Wyoming
Capacity, 176,000

State Gasoline Corp., 900 Spring Arcade Bldg., Los Angeles, Calif.
Pres., J. W. Jameson
V. P., M. P. Simon
Sec. and Treas., S. W. McComb
Gen. Supt., K. G. Steinbeck
Plants in California
Capacity, 57,500

Sterling Oil & Gas Co., 506 Thompson Bldg., Tulsa, Okla.
Pres., C. H. Petry
V. P. and Gen. Mgr., W. S. Duty
Sec. and Treas., A. E. Schmitz
Div. Supt., T. T. Curtis
Plant in Oklahoma
Capacity, 250

Stranahan & Cheuvront, 405 West Main St., Oblong, Ill.
Sec. and Treas., A. B. Cheuvront
Pur. Agt., A. B. Cheuvront

Supt., J. F. Brown, 408 W. Main St., Oblong, Ill.
Plants in Illinois
Capacity, 75

Success Oil Co., 503 West Elm St., Titusville, Pa.
Pres., Geo. H. Davis
Gen. Supt., A. Porter, Sr.
Ch. Egr., A. Porter, Jr.
Plant in Pennsylvania
Capacity, 2,000

Sunray Oil Co., 740 Philcade Bldg., Tulsa, Okla.
Receiver, C. H. Wright
Gen. Supt., J. E. Thompson
Sales Mgr., F. L. Martin
Supt., J. E. Thompson
Plant in Texas
Capacity, 8,000

Superior Oil Co., 1101 Nat'l City Bank Bldg., Los Angeles, Calif.
Pres., W. M. Keck
V. P.s, J. P. Chandler, Chas. A. Dore and W. A. Pruett
Sec. and Treas., J. P. Chandler
Asst. Treas., Howard W. Wright
Asst. Secs., F. D. Jones, Virgil L. Smith
Pur. Agt., Geo. H. Barry
Plants in California
Capacity, 113,000

Surety Oil Co., Titusville, Pa.
Plant in Pennsylvania
Capacity, 1,000

Sutton Brothers, Inc., 1370 Ridge Ave., Steubenville, Ohio
Pres., H. L. Sutton
V. P., C. E. Sutton
Sec. and Treas., N. A. Sutton
Plant in West Virginia
Capacity, 200

T

Tarbell & Co., Grand Valley, Pa.
Plant in Pennsylvania
Capacity, 80

Test Oil Co., Bartlesville, Okla.
Pres., M. R. Moran
Plant in Oklahoma
Capacity, 500

Texas, Company, General Offices: 135 E. 42nd St., New York City
Ch. of Bd., C. B. Ames, New York City
Ch. Exec. Com., J. H. Lapham
Pres., W. S. S. Rodgers
V. P.s, T. J. Donoghue, F. T. Manley, G. L. Noble, R. Ogarrio, T. Rieber and H. W. Dodge
Sec., E. M. Crone
Treas., C. E. Woodbridge
Pur. Agt., A. F. Colling
Supts., M. J. Adams (North Tex. Div.) Wichita Falls, Tex.; T. F. O'Brien (West Tex. and N. Mex. Div.), Cisco, Tex.; J. L. Shea (La. and Ark. Div.), Shreveport, La.; C. C. Kelly (Okla. and Kans. Div.), Tulsa, Okla.
Plants in Oklahoma, Texas, Kansas and Louisiana
Capacity, 168,000

Texas Company, California, 929 So. Broadway, Los Angeles, Calif.
Pres. and Gen. Mgr., C. E. Olmstead
V. P.s, J. A. Bermingham, H. W. Dodge, R. T. Herndon, L. R. Holmes
Gen. Coun., C. C. Stanley
Sec., E. M. Crone
Treas., C. E. Woodbridge
Sales Mgr., R. T. Herndon
Supts., H. S. Cole, Jr., Asst. Gen. Supt., 929 So. Broadway, Los Angeles, Calif.; N. H. Mull, Supt. of Gasoline Plant Operations, Los Angeles, Calif.
Plants in California
Capacity, 215,000

Texas Pacific Coal & Oil Co., 1710 Fort Worth Nat'l Bank Bldg., Fort Worth, Tex.
Pres., E. J. Marston
V. P.s, Dr. E. R. Lederer, O. E. Mitchell and John Hancock
Sec. and Treas., R. Seibel
Pur. Agt., J. C. Davis
Ch. Chem., E. W. Zublin
Ch. Egr., H. H. Pruitt
Supts., D. B. Hiatt, Thurber, Tex.; Jack White, Strawn, Tex.; C. S. Bronsteadt, Caddo, Tex.
Plants in Texas
Capacity, 35,000

Texoma Natural Gas Co., 20 North Wacker Drive, Chicago, Ill.
Pres., Judge H. O. Castor
V. P. and Gen. Mgr., Floyd C. Brown
Asst. Sec., S. E. Campbell
Asst. Treas., F. K. Macdonald
Gen. Supt., E. V. Kesinger
Pur. Agt., G. R. Locke
Ch. Chem., E. G. Hammerschmidt
Ch. Egr., G. M. Davidson
Supt., R. T. Powers, P. O. Box 36, Fritch, Tex.
Plant in Texas
Capacity, 60,000

Thomas, R. L., 290 Main St., Tidioute, Pa.
Owner, R. L. Thomas
Plant in Pennsylvania
Capacity, 250

Tide Water Oil Co. (Okla.), Box 731, Tulsa, Okla.
Pres. E. L. Shea
V. P., C. R. Barton, charge mfg.
Sec., Y. P. Broome
Treas., K. R. Hankinson
Sales Mgr., J. W. Warner
Pur. Agt., P. W. Fenton
Ch. Chem., R. W. Boyd
Ch. Egr., M. D. Harris
Supt., R. S. Stanfield, Drumright, Okla.
Plants in Oklahoma
Capacity, 15,000

Tompsett Brothers, Tidioute, Pa.
Pres., W. C. Tompsett
Plant in Pennsylvania
Capacity, 500

Triangle Co., Box 100, McKees Rocks, Pa.
Pres., J. B. Montgomery
Sec., Bert Noble
Treas., S. H. Morgan
Sales Mgr., Bert Noble
Pur. Agt., Bert Noble
Ch. Egr., A. A. Bock
Plant in Pennsylvania
Capacity, 450

Triumph Petroleum Co., Route 3, Tidioute, Pa.
Co-partnership
E. R. Johnson, one of partners
Plant in Pennsylvania
Capacity, 175

Tuel & Thoenen, National Bank Bldg., Sistersville, W. Va.
Supt., Manford Tuel, Sistersville, W Va.
Plant in Ohio
Capacity, 200

Tyler Oil Co., Sistersville, W. Va.
Pres., H. J. Crawford
V. P., J. P. Flynn
Sec., Nell B. McCoy
Gen. Supt., J. P. Flynn
Plants in West Virginia and Ohio
Capacity, 149

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Union Gasoline Co., Security Nat'l Bank Bldg., Independence, Kans.
Pres., Paul R. Johnson
V. P., D. W. Stewart
Sec., V. F. Palmer
Treas., H. F. Mitchell
Gen. Supt., C. A. Lloyd
Sales Mgr., H. F. Mitchell
Pur. Agt., W. L. Orr
Supt., J. D. Copeland, Caney, Kans.
Plant in Oklahoma
Capacity, 2,000

Union Gasoline & Oil Corp., (Same Offices as Virginian Gasoline & Oil Co.)
Plants in West Virginia
Capacity, 8,280

Union Gas Products, Inc., 710 Ouachita Bank Bldg., Monroe, La.
Pres., D. S. Lansden
V. P., C. M. Rose
Sec., Henry Bernstein

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BOOTH 105 TEXAS BLDG.

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Gen. Supt., H. C. Walton
Pur. Agt., H. C. Walton
Plant in Louisiana
Capacity, 6,000

Union Oil Co. of California, 617 West 7th St., Los Angeles, Calif.
Pres., L. P. St. Clair
V. P.s, R. D. Mathers, W. W. Orcutt, W. L. Stewart, Jr. and P. M. Gregg
Sec., John McPeak
Treas., J. M. Rust
Mgr. of Sales, V. H. Kelly
Mgr. of Research, Dr. D. R. Merrill
Mgr. of Purch., H. C. Farquhar
Supts., Lafe Todd (Northern Div.), San Luis Obispo, Calif.; J. C. Rector (Southern Div.), Santa Fe Springs, Calif.
Plants in California
Capacity, 237,750

United Carbon Co., Union Bldg., Charleston, W. Va.
Pres., Oscar Nelson
V. P., G. A. Williams, Clarksburg, W. Va., and H. C. Pearson, Charleston, W. Va.
Sec., C. H. McHenry, Monroe, La.
Treas., T. A. Whalen, Weston, W. Va.
Gen. Supt., W. W. Engstrom, Monroe, La.
Sales Mgr., A. G. Treadgold, Charleston, W. Va.
Pur. Agt., C. A. Urban, Charleston, W. Va.
Ch. Chem., E. P. Kearsley, Charleston, W. Va.
Ch. Egr., H. E. Norrick, Monroe, La.
Supts., H. Balch, Swartz, La.; T. Miller, Swartz, La.; A. J. MacKinnon, Swartz, La.; Tom Motley, Monroe, La.; J. M. Eldridge, Monroe, La.; C. M. Peters, Monroe, La.; E. L. Barron, Alto, La.
Plants in Louisiana
Capacity, 20,000

United Gas Public Service Co., Rusk Bldg., Houston, Tex.
Pres., N. C. McGowen
V. P., R. H. Hargrove
Comptroller, S. L. Davis
Sec., George D. Fiser
Treas., J. B. LeBow
Gen. Supt., F. L. Rhoades, Shreveport, La.
Pur. Agt., R. A. Reeder
Sales Mgr., W. F. Fulton
Ch. Chem., W. F. Fulton
Ch. Egr., A. D. Greene
Supts., H. S. Ridings Cotton Valley, La.; L. O. Lawless, (Latex), Bethany, La.; W. H. McCalip, (Sugar Creek), Athens, La.; F. C. Dugan, Refugio, Tex.; O. M. Campbell, Archibald, La.
Plants in Louisiana and Texas
Capacity, 201,800

Universal Consolidated Oil Co., 555 Flower St., Los Angeles, Calif.
Pres., O. H. Muller, Jr.
V. P.s, E. G. Starr, R. D. Montgomery, R. E. Stearns
Sec. and Treas., J. S. Wallace
Gen. Supt., Geo. A. Coffey
Pur. Agt., P. J. Hays
Pet. Eng., G. S. Follansbee, Jr.
Supts., F. V. Falenzer, Box B, Oilfields, Calif.; L. F. Barrows, Lost Hills, Calif.
Plant in California
Capacity, 2,000

V

Victor Gasoline Co., 624 So. Cheyenne Ave., Tulsa, Okla.
Pres., M. F. Powers
V. P., C. P. Quinlan
Sec., J. L. Goddard
Treas., Felix Quinlan, Jr.
Gen. Supt., M. F. Powers
Sales Mgr., E. C. Sager
Pur. Agt., Chas. Buthad
Ch. Chem., Jas. Edwards
Ch. Egr., F. G. Hunze
Supts., L. J. Rush, Bristow, Okla.; D. B. Gilmore, Bristow, Okla.; T. N. Rutherford, Seminole, Okla.; Al Brunner, Seminole, Okla.
Plants in Oklahoma
Capacity, 11,000

Viking Distributing Co., (Same Offices as Virginian Gasoline & Oil Co.)
Plants in West Virginia
Capacity, 1,000

Vincennes Oil & Gas Co., Vincennes, Ind.
Pres., E. M. Kerlin
V. P., C. E. Kerlin
Sec. and Treas., R. D. Green
Gen. Supt., R. C. Kerlin
Pur. Agt., R. D. Green
Supt., Homer Means, Route 4, Lawrenceville, Ill.
Plant in Illinois
Capacity, 5,000

Virginian Gasoline & Oil Co., Quarrier & Dunbar Sts., Charleston, W. Va.
Pres., H. A. Wallace
V. P.s, D. A. Ketchum and E. Reynolds, Jr.
Sec., E. Reynolds, Jr.
Treas., W. J. Hightower
Gen. Supt., R. N. Parks
Sales Mgr., R. N. Parks
Pur. Agt., C. S. Duffield
Plants in West Virginia
Capacity 166,250

W

Waggoner Gasoline Co., Electra, Tex.
Pres., W. T. Waggoner, Sr.
V. P., G. L. Waggoner
Sec. and Treas., E. P. Waggoner
Gen. Supt., A. E. Stuard
Sales Mgr., H. D. Jenkins
Pur. Agt., J. T. McNamara
Plant in Texas
Capacity 20,000

Wahl, A. R., 249 Main St., Evans City, Pa.
Owner, A. R. Wahl
Gen. Supt., Fred Buhl Wahl
Plant in Pennsylvania
Capacity, 150

Ward Gasoline Co., Box 507, Sayre, Okla.
Pres., J. C. Ward
V. P., W. F. Seeger
Sec. and Treas., Ewell Nalle
Sales Mgr. and Pur. Agt., W. F. Seeger
Supt., Herman Cornett, Breckenridge, Tex.
Plant in Texas
Capacity, 5,000

Warner-Caldwell Oil Co., Second Nat'l Bank Bldg., Titusville, Pa.
Pres., Alex N. Warner
V. P., J. H. Caldwell, Jr.
Sec. and Treas., Floyd August
Gen. Supt., P. C. Hatfield, Okla.; Alex N. Warner, Pa.
Supts., Roy Porter, R.F.D., Nowata, Okla.; Ferman Van Winkle, Pumpkin Center, Okla.; Glen Albert, R. F. D., Nowata, Okla.; F. O. Merrill, R. F. D., Nowata, Okla.; John T. Dalton, R. F. D. 2, Titusville, Pa.
Plants in Oklahoma and Pennsylvania
Capacity, 5,600

Warren Petroleum Co., 2001 National Bank of Tulsa Bldg., Tulsa, Okla.
Pres., W. K. Warren
V. P., J. A. La Fortune
Sec., H. E. Felt
Treas., A. J. Murphy
Sales Mgr., J. A. La Fortune
Owns interest in J. E. Crosbie, Inc., Holdenville, Okla., plant and American Natural Gasoline Co., now building 45,000-gallon plant at Ramsdell, Tex.

Washington Development Co., 715 Central Bldg., Wichita, Kans.
Pres., L. W. Cary
V. P., E. C. Joullian
Sec. and Treas., F. A. R. McFadden
Gen. Supt., C. S. Worley
Sales Mgr., C. S. Worley
Ch. Egr., H. W. Shaffer
Supt., H. W. Shaffer, Wellington, Kans.
Plant in Kansas
Capacity, 10,000

Wentz, L. H. (Oil Division), Ponca City, Okla.
Gen. Supt., O. H. Schoenwald
Pur. Agt., S. C. Harkness
Plants in Oklahoma
Capacity, 4,500

West Coast Refining Co., 1320 Pacific Finance Bldg., Los Angeles, Calif.
Pres., A. H. Bradford
V. P., M. D. Schatzman
Sec. and Treas., W. B. Ogden
Gen. Supt., W. M. Bradford
Plants in California
Capacity, 50,000

Western Gasoline Co., National Bank of Tulsa Bldg., Tulsa, Okla.
Pres., W. K. Warren
V. P., J. A. LaFortune
Sec., H. E. Felt
Treas., A. J. Murphy
Gen. Supt. and Pur. Agt., Don Smith
Plant in Oklahoma
Capacity, 4,500

Western Oil Corp. of Texas, Philcade Bldg., Tulsa, Okla.
Pres., J. F. Darby
V. P., Carl Pursel
Sec. and Treas., C. F. Lynde
Supt., J. R. Gilbert, Electra, Tex.
Plant in Texas
Capacity, 2,000

Western States Gasoline Corp., 609 So. Grande Ave., Los Angeles, Calif.
Pres., C. R. Gallagher
V. P., E. McGowan
Sec., G. C. O'Connell
Gen. Supt., W. N. Roper
Plant in California
Capacity, 160,000

Westoak Gasoline Co., Box 507, Sayre, Okla.
Pres., T. J. Butler
V. P., W. F. Seeger
Sec. and Treas., Ewell Nalle
Gen. Supt. and Pur. Agt., W. F. Seeger
Plant in Oklahoma
Capacity, 10,000

Wheeler, D. H., Box 86, Petrolia, Pa.
Plant in Pennsylvania
Capacity, 200

Wilcox (H. F.), Oil & Gas Co., 310 W. Sixth St., Tulsa, Okla.
Pres., Homer F. Wilcox
V. P. and Gen. Mgr., G. A. Dye
V. P. and Gen. Supt., F. H. Dunn
V. P. and Treas., M. P. Appleby
Sec., L. J. Yarbrough
Sales Mgr., H. E. Bangert
Pur. Agt., H. B. Ward
Ch. Chem., W. M. Fraser
Ch. Egr., W. R. Bingham
Supts., H. W. McCulloh, Box 398, Pampa, Tex.; Roy Banter, Box 368, Bristow, Okla.
Plants in Oklahoma and Texas
Capacity, 10,500

Wilshire Oil Co., Inc., 2455 East 27th St., Los Angeles, Calif.
Pres., Alfred P. Machris
Gen. Supt., W. D. Smith
Sales Mgr., M. M. Fletcher
Pur. Agt., A. Pateracki
Ch. Chem., T. B. Gates
Supts., T. B. Gates, 2455 E. 27th St., Los Angeles, Calif.; Mr. Seppi, 2455 E. 27th St., Los Angeles, Calif.; W. D. Smith, 2455 E. 27th St., Los Angeles, Calif.
Plant in California
Capacity, 110,000

Wirt Franklin Petroleum Corp., Ardmore, Okla.
Pres., Wirt Franklin
V. P.s, F. M. Porter, Walter Gant and Chester Franklin
Sec. and Treas., E. Galt
Gen. Supt., R. R. Owens
Sales Mgr., Chester Franklin
Pur. Agt., R. R. Owens
Ch. Chem., D. E. Logan
Ch. Egr., R. R. Owens
Supts., Chas. Chaney, care of Wirt Franklin Pet. Corp., Oklahoma City, Okla.; J. F. Looker, care of Wirt Franklin Pet. Corp., Oklahoma City, Okla.
Plants in Oklahoma
Capacity, 50,000

Wirt Gasoline Co., 91 Main St., Bradford, Pa.
Pres., Nathan Nichols
Sec., Charles Nichols
Treas., Nathan Nichols
Gen. Supt., Charles Nichols
Ch. Egr., L. L. Hardman
Supt., John Gould, Bolivar, New York
Plant in New York

Wiser Oil Co., Trico Bldg., Sistersville, W. Va.
Pres., W. L. Sutton
V. P.s, A. C. Jackson and M. B. Hutchison
Pur. Agt. and V. P., E. Arthur Durhan
Sec., L. E. Gregg
Treas., P. W. Neuenschwander
Supts., H. G. Ellis, Bartlesville, Okla.; H. J. Brooks, Alluwe, Okla.
Plant in Oklahoma
Capacity, 2,100

Wolverine Petroleum Corp., Shell Bldg. St. Louis, Mo.
Pres., Alexander Fraser
V. P.s, J. W. Watson and H. H. Anderson
Sec. and Treas., P. R. Chenoweth
Pur. Agt., C. B. Singleton
Supts., S. U. Young, Dillard, Okla.; R. R. Dollins, Avant, Okla.; R. R. Dollins, Wilson, Okla.
Plants in Oklahoma
Capacity, 18,500

Wright (J. H) Estates, Sapulpa, Okla.
Executrix, Rosa B. Wright
Gen. Supt., A. B. Nigh
Sales Mgr., M. L. Murphy
Ch. Chem., A. B. Nigh
Ch. Egr., A. B. Nigh
Plant in Oklahoma
Capacity, 4,500

Life of Bradford Field Subject of Calculation

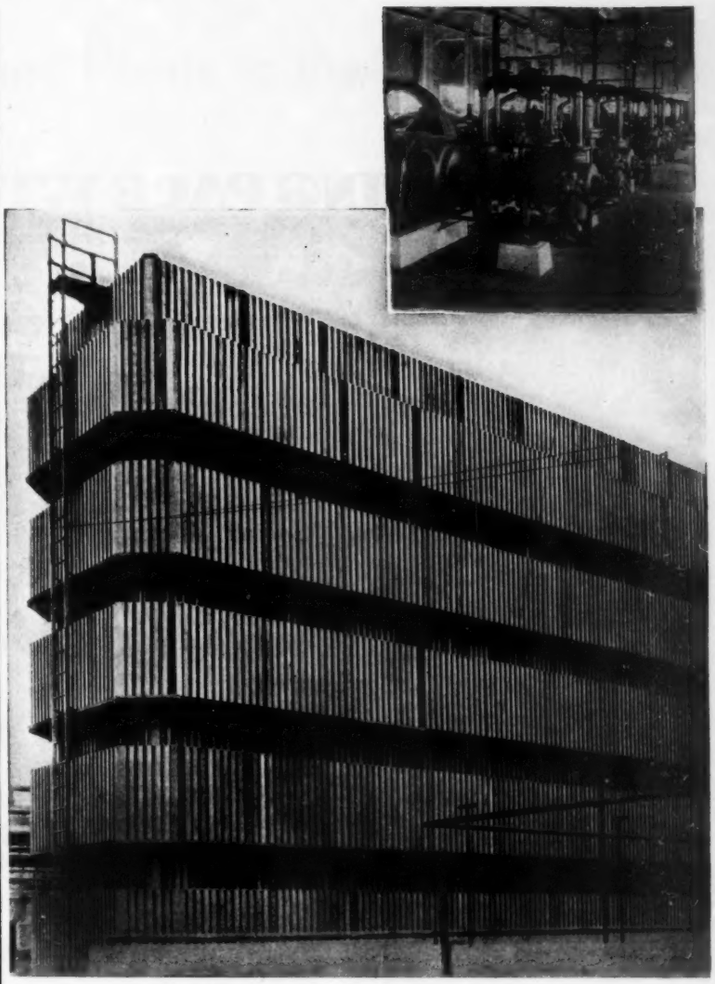
OLEAN, N. Y., May 5.—Another college petroleum department has enlisted in the quest for a re-agent which may be added to water used in flooding properties in the Bradford and Allegany Fields to increase the ultimate yield of crude oil, it was learned here when Prof. Harold J. Tormey, of St. Bonaventure College, spoke at the conclusion of a discussion by Arthur C. Simmons, petroleum engineer and geologist of Bradford.

Mr. Simmons' presentation covered the methods of determining saturation and probable oil content in the sand, and it was pointed out that the search for a chemical compound which will release the residual deposits of oil still clinging to the sand has been intensive in the past few months. Professor Tormey said his department, chemistry, was showing considerable interest in recovery problems.

A recent estimate on the effects of increasing the ultimate recovery of oil in the Bradford Field alone is that of A. W. Gauger, head of the mineral industries research department of Pennsylvania State College. Mr. Gauger said: "It is difficult to arrive at a figure for the oil saturation in the Bradford Field, but it is believed that 60 per cent of the original oil remains in the sand. If one assumes a sand thickness average of 40 feet, a porosity of 14 per cent, and an oil saturation of 60 per cent, the oil content figures at 26,000 bbls. an acre. Assuming that the oil saturation is brought down to 40 per cent by water flooding, the recovery will be 8,700 bbls. an acre. If a method is devised whereby the oil saturation may be decreased to 30 per cent, an additional 4,300 bbls. per acre will be recovered. Taking 80,000 acres as the area of the territory in the Bradford Field to be flooded, the decrease of oil saturation to 30 per cent would mean an additional 344,000,000 bbls. of oil. Production at the rate of 30,000 bbls. a day in the field would mean that the life of the Bradford Field would be extended more than 30 years."

NORTHERN PIPE LINE

OIL CITY, Pa., May 5.—D. S. Bushnell, J. H. Peper, and David Gregg, Jr., all of New York City, were elected directors of the Northern Pipe Line Co. today. Mr. Bushnell is president, J. A. Bartlett is vice president and general manager, and P. R. Applegate of New York, vice president in charge of operations. J. R. Fast and C. H. Cleaver, also of New York, are secretary and treasurer, respectively.



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NEW YORK, N. Y. 220 East 42nd St.
TULSA, OKLA. Philtower Bldg.
CHICAGO, ILL. McCormick Bldg.
CLEVELAND, OHIO Terminal Tower Bldg.

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TULSA, OKLAHOMA

GASOLINE PLANTS—HEAT EXCHANGERS—REFINING EQUIPMENT

1934 Survey of Natural Gasoline Plants in the United States

STAR (*)—PLANT SHUT DOWN; ABSP.—ABSORPTION; COMP.—COMPRESSION; C-A—COMPRESSION ABSORPTION; CHAR.—CHARCOAL

ARKANSAS

Company and plant address—	Field location—	Type of plant	Daily cap'y (gals.)
Arkansas Natural Gas Corp., El Dorado	Sec. 31-17s-15w	C-A	5,000
Gulf Refining Co. of Louisiana, El Dorado	El Dorado south field	Absp.	4,000
Henderson Co., El Dorado	El Dorado	C-A	11,000
Imperial Oil & Gas Products Co., Smackover	Smackover	Comp.	500
Magnolia Petroleum Co., Kenova	Sec. 8-15-16, Union County	Absp.	6,800
Reserve Development Co., Tulsa	Louana	Absp.	5,000
Rainbow Gasoline Corp., Tulsa, Okla.	Sec. 10-17-14	C-A	20,000
Standard Oil Co. of Louisiana	El Dorado, 3 mi.	C-A	19,234
Standard Oil Co. of Louisiana	Smackover, 3 mi.	Absp.	516

CALIFORNIA

Company and plant address—	Field location—	Type of plant	Daily cap'y (gals.)
American Natural Gasoline Corp., Santa Maria,	Santa Maria Field	Absp.	*7,500
Bankline Oil Co., Willow St., Signal Hill	Farm Lot 64, Signal Hill	Absp.	25,000
Barnsdall Oil Co. of California, Goleta	Sec. 14-14n-29w	Absp.	65,000
Beiridge Oil Co., Taft	Elk Hills, Sec. 34-30-24	Absp.	7,000
Beiridge Oil Co., McKittrick	Belridge, Sec. 26-27-20	Absp.	50,000
Beiridge Oil Co., McKittrick	South Belridge, Sec. 23-28-27	Absp.	*5,000
Beiridge Oil Co., McKittrick	Belridge, Sec. 35-27-20	Absp.	5,000
Bolsa Chica Oil Corp., Ventura	Ventura	Absp.	*15,000
Bolsa Chica Oil Corp., Ventura	Ventura	Absp.	*6,000
Brea Canyon Oil Co.	Coyote Hills	C-A	14,000
Calumet Oil Co., Fillmore	Sec. 3-3-19, Ventura County	Comp.	1,000
Coline Gasoline Corp., Torrance	Lot 2, Rancho San Pedro	Absp.	10,000
Coline Gasoline Corp., Ventura	Sec. 17-3-24	Absp.	6,000
Del Rey Oil & Gas Co.	Venice	Absp.	15,000
Del Rey Oil & Gas Co.	Inglewood	Absp.	*5,000
Cowan Oil & Refining Co., 6th and Spring St., Los Angeles	Rosecrans	Absp.	10,000
Del Rey Oil & Refining Co., Ltd., 21 Ave. 43, Venice	500 ft. E and 30 ft. S from NE cor., Lot 14, Blk. 13, Del Rey Beach	Absp.	60,000
Edington Gasoline & Refining Co., Inglewood	Aerick & Eastwood Sts., Inglewood	Absp.	6,000
Export Refining Co., Torrance	Torrance Field	.....	*20,000
Field, O. C., Gasoline Corp., 609 Board of Trade Bldg., Los Angeles	Huntington Beach	Absp.	30,000
Field, O. C., Gasoline Corp., 609 Board of Trade Bldg., Los Angeles	Maricopa	Absp.	10,000
Fullerton Oil Co., R.F.D. 3, Box 72, Fullerton	Sec. 2-3-10w, Orange County	Absp.	6,000
General Petroleum Corp. of California, Higgins Bldg., Los Angeles	Santa Fe Springs	Absp.	175,000
General Petroleum Corp. of California, Higgins Bldg., Los Angeles	Ventura	Absp.	40,000
General Petroleum Corp. of California, Higgins Bldg., Los Angeles	Athens	C-A	40,000
General Petroleum Corp. of California, Higgins Bldg., Los Angeles	Brea Canyon	Absp.	10,000
Getty, Geo. F., Gasoline Co., 1060 Subway Terminal Bldg., Los Angeles	Seal Beach	Absp.	10,000
Gilmore Gasoline Plant No. 1, 2423 E. 28th St., Los Angeles	Lot 1, Tract 708, Signal Hill	Absp.	30,000
Gilmore-Dabney, 2423 E. 28th St., Los Angeles	Price and Peterson tract, Signal Hill	Absp.	*20,000
Gilmore-Dabney, 2423 E. 28th St., Los Angeles	Lots 49-56, Resub. Ass'n. Heights, Long Beach	Absp.	*30,000
Gilmore-Dabney, 2423 E. 28th St., Los Angeles	Tract 2,901, Long Beach	Absp.	30,000
Highway Gasoline Co., Ventura	Ventura Field	Absp.	20,000
Highway Gasoline Co., Ventura	Ventura Field	Absp.	*3,000
Honolulu Oil Corp., Ltd., 215 Market St., San Francisco	Sec. 8-32s-24e, Kern City	C-A	30,000
Honolulu Oil Corp., Ltd., 215 Market St., San Francisco	Sec. 8-32s-24e, Kern City	C-A	30,000
Hokom Oil & Gasoline Co. (J.), Lawndale	Lawndale	Absp.	5,000
Lomita Gasoline Co., Box 669, Long Beach	Signal Hill	Absp.	40,000
Los Nietos Producing & Refining Co., Ltd.	Sec. 2-22s-17e	Absp.	100,000
Mohawk Petroleum Co., 20 Ave. 44, Venice	45th and Speedway, Venice	Absp.	10,000
North American Oil Consolidated, Room 915, Balfour Bldg., San Francisco	Sec. 28-31s-23e, M.D.B.&M., Kern County	Absp.	3,000
Norwalk Co., The, Santa Fe Springs	SE ¼W, Sec. 6, T. 3s, R. 11w, S.B.B.&M.	Absp.	50,000
Norwalk Co., The, Bin WW, Taft	Sec. 30, T. 31s, R. 24e, M.D.B.&M.	Absp.	10,000
Norwalk Co., The, Bin WW, Maricopa	SE, Sec. 36, T. 12n, R. 24e, S.B.B.&M.	Absp.	10,000
Ohio Oil Co., Los Angeles	Los Angeles County	Absp.	20,000
Pacific Western Oil Co., Drawer 86, Goleta	Goleta lease, Elwood	Absp.	20,000
Pacific Western Oil Co., Drawer Z, Ventura	Willett lease, Ventura Ave.	Absp.	20,000
Rancho La Brea Oil Co., Salt Lake	Salt Lake Field	Absp.	5,000
Reservoir Hill Gasoline Co., 855 Subway Terminal Bldg., Los Angeles	Lot 24, Alamitos, Long Beach	Absp.	12,000
Rice Ranch Oil Co., 262 S. Los Angeles St., Los Angeles	Santa Maria Field	Absp.	6,000
Rio Grande Oil Co., 855 Subway Terminal Bldg., Los Angeles	Santa Fe Springs	Absp.	10,000
Ryan & Hackett Co., Inc., 511 Associated Realty Bldg., Los Angeles	Signal Hill	Absp.	*3,000
St. Helens Petroleum Co., Ltd., Box 248, Montebello	Sec. 2-2-12, Los Angeles	Absp.	750
St. Helens Petroleum Co., Ltd., Box D, Taft	Sec. 16-32-24, Kern County	Absp.	2,500
Shell Oil Co. of California, 200 Bush St., San Francisco	Graxide lease, Coyote Hills	Absp.	40,000
Shell Oil Co. of California	Sec. 27, Coalinga Hills	Absp.	*4,000
Shell Oil Co. of California	Reyes, Dominguez Field	Absp.	32,000
Shell Oil Co. of California	Rindge, Inglewood Field	Absp.	10,000
Shell Oil Co. of California	Coseboom, Long Beach	Absp.	220,000
Shell Oil Co. of California	Careaga, Santa Maria Field	Absp.	4,000
Shell Oil Co. of California	Gosnell, Ventura Field	Absp.	130,000
Signal Oil & Gas Co., 811 W. 7th St., Los Angeles	Signal Hill	Absp.	30,000
Signal Oil & Gas Co., 811 W. 7th St., Los Angeles	Signal Hill	Absp.	20,000
Signal Oil & Gas Co., 811 W. 7th St., Los Angeles	Signal Hill	Absp.	10,000
Signal Oil & Gas Co., 811 W. 7th St., Los Angeles	Signal Hill	Absp.	*15,000
Signal Oil & Gas Co., 811 W. 7th St., Los Angeles	Signal Hill	Absp.	*10,000
Signal Hill Gasoline Co., Long Beach	Long Beach Field	Absp.	35,000
Signal Hill Gasoline Co., Long Beach	Long Beach Field	Absp.	*10,000
Signal Hill Gasoline Co., Elk Hills	Elk Hills Field	Absp.	5,000
Signal Hill Gasoline Co.	Sunset-Midway Field	Absp.	*3,000
Signal Hill Gasoline Co., Seacliff	Seacliff Field	Absp.	*15,000
Signal Hill Gasoline Co., Huntington Beach	Huntington Beach Field	Absp.	*15,000
Signal Hill Gasoline Co.	Sunset-Midway Field	Absp.	*2,000
Southwest Refining Co., Long Beach	Long Beach	Absp.	*5,000
Standard Gasoline Co., 225 Bush St., San Francisco	Santa Fe Springs	Booster	15,000
Standard Gasoline Co.	Santa Fe Springs	Absp.	*45,000
Standard Gasoline Co.	Santa Fe Springs	Comp.	Booster
Standard Gasoline Co.	Santa Fe Springs	Absp.	46,000
Standard Gasoline Co.	Montebello	Booster	*2,300
Standard Gasoline Co.	Murphy Coyote	Absp.	20,000
Standard Gasoline Co.	Kraemer	Absp.	*5,500
Standard Gasoline Co.	Brea	Absp.	6,500
Standard Gasoline Co.	Huntington Beach	Absp.	*10,000
Standard Gasoline Co.	Huntington Beach	Absp.	*10,000
Standard Gasoline Co.	Huntington Beach	Absp.	*20,000
Standard Gasoline Co.	Huntington Beach	Absp.	20,000
Standard Gasoline Co.	Huntington Beach	Absp.	10,000
Standard Gasoline Co.	Seal Beach	Absp.	40,000
Standard Gasoline Co.	Seal Beach	Booster	15,000
Standard Gasoline Co.	Long Beach	Booster	*7,000
Standard Gasoline Co.	Long Beach	Absp.	*2,500
Standard Gasoline Co.	Long Beach	Absp.	30,000
Standard Gasoline Co.	Dominguez	Absp.	6,755
Standard Gasoline Co.	Inglewood	Absp.	*6,000
Standard Gasoline Co.	Inglewood	Absp.	7,500
Standard Gasoline Co.	Torrance	Absp.	6,000
Standard Gasoline Co.	Whittier	Absp.	375
Standard Gasoline Co.	Cypress	Absp.	4,500
Standard Gasoline Co.	Ventura	Absp.	*12,000
Standard Gasoline Co.	Ventura	Absp.	40,000
Standard Gasoline Co.	Ventura	Absp.	40,000
Standard Gasoline Co.	Ventura	Booster	
Standard Gasoline Co.	Newhall	Absp.	*1,000
Standard Gasoline Co.	Taft	Absp.	20,000
Standard Gasoline Co.	Taft	Absp.	30,000
Standard Gasoline Co.	Taft	Absp.	6,000
Standard Gasoline Co.	Taft	Absp.	6,000
Standard Gasoline Co.	Taft	Absp.	*10,000
Standard Gasoline Co.	Taft	Absp.	7,500
Standard Gasoline Co.	Taft	Absp.	15,000
Standard Gasoline Co.	Taft	Booster	(*)
Standard Gasoline Co.	Taft	Absp.	*12,000
Standard Gasoline Co.	Taft	Absp.	*7,000
Standard Gasoline Co.	Wheeler Ridge	Absp.	*500
Standard Gasoline Co.	Kettleman Hills	Absp.	110,000
Standard Gasoline Co.	Kettleman Hills	Absp.	140,000
Standard Gasoline Co.	Kettleman Hills	Absp.	80,000
Standard Gasoline Co.	Kettleman Hills	Absp.	80,000
State Gasoline Corp., 900 Spring Arcade Bldg., Los Angeles	Long Beach	Absp.	15,000
State Gasoline Corp.	Long Beach	Absp.	22,500
State Gasoline Corp.	Long Beach	Absp.	*20,000
Superior Oil Co., 1100 Natl. City Bank Bldg., Los Angeles	Joughin lease, Torrance Field	Absp.	2,300
Superior Oil Co.	Kettleman Hills Field	Absp.	110,000
Texas Company, The (California)	Signal Hill	Absp.	75,000
Texas Company, The (California)	Santa Fe Springs	Absp.	75,000
Texas Company, The (California)	Huntington Beach	Absp.	20,000
Texas Company, The (California)	Montebello	Absp.	2,500
Texas Company, The (California)	Sec. 2-22-17e	Comp.	10,500
Texas Company, The (California)	Fillmore-Shield	Absp.	2,500
Union Oil Co. of California, Placentia	Morse lease, Richfield Field	Absp.	20,000
Union Oil Co. of California, Brea	Stearns lease, Brea Field	Absp.	22,500
Union Oil Co. of California, Santa Fe Springs	Bell lease, Santa Fe Springs	Absp.	100,000
Union Oil Co. of California, Compton	Wellman lease, Dominguez Field	Absp.	50,000
Union Oil Co. of California, Athens	Rosecrans lease, Rosecrans Field	Absp.	27,000
Union Oil Co. of California, Santa Paula	Santa Paula refinery, Santa Paula Field	Absp.	250
Union Oil Co. of California, Orcutt	Newlove lease, Santa Maria Field	Absp.	18,000
Universal Consolidated Oil Co., 808 Richfield Bldg., Los Angeles	Lost Hills Field	Absp.	*2,000
West Coast Refining Co., 1320 Pacific Finance Bldg., Los Angeles	Richfield	Absp.	50,000
Western States Gasoline Corp., 609 S. Grand, Los Angeles	Sec. 2-22-17	Absp.	160,000
Wilshire Oil Co., Inc., 2455 E. 27th St., Vernon	Santa Fe Springs	Absp.	110,000

COLORADO

Company and plant address—	Field location—	Type of plant	Daily cap'y (gals.)
Continental Oil Co., Denver, Colo.	Sec. 30-68w-8n	Absp.	1,000
Continental Oil Co., Denver, Colo.	Sec. 31-68w-10n	Absp.	6,000
Mountain States Oil Corp.	Barela, S. W.	Absp.	6,000

ILLINOIS

Company and plant address—	Field location—	Type of plant	Daily cap'y (gals.)
American Oil Development Co., 1601 Oliver Bldg., Pittsburgh, Pa.	Crawford County	Comp.	100
American Oil Development Co., 1601 Oliver Bldg., Pittsburgh, Pa.	Crawford County	Comp.	100
American Oil Development Co., 1601 Oliver Bldg., Pittsburgh, Pa.	Crawford County	Comp.	50
Arkansas Fuel Oil Co., Robinson	Sec. 3, Prairie Twp., Crawford	Comp.	2,000
Tide Water Oil Co., 17 Battery Place, New York, N. Y.	Crawford County	Comp.	1,300
Bell Bros., Robinson	Casey	Comp.	150
Bell Bros., Robinson	Robinson	Comp.	130
Big Four Oil & Gas Co., Pittsburgh, Pa.	Bridgeport	Comp.	300
Brenneman & MacDonell, Oblong	Sec. 6-6-13, Crawford County	Comp.	1,000
Brenneman & MacDonell, Oblong	Sec. 7-7-13, Crawford County	Comp.	250
	Crawford County	Comp.	2,000
International Oil & Gas Co., Washington, Pa.	Oblong	Comp.	225
Kennedy, W. C., Co., Bradford, Pa.	Crawford	Comp.	350
Kewanee Oil & Gas Co., Robinson	Lawrence County	Comp.	135
Kewanee Oil & Gas Co., Robinson	Sec. 17-7-13	Comp.	350
Mahutska Oil Co., Robinson	Sec. 28-6-13	Comp.	250
Mahutska Oil Co., Robinson	Sec. 10-6-13	Comp.	1,000
Mahutska Oil Co., Robinson	Sec. 30-7-13	Comp.	500
Mahutska Oil Co., Robinson	Oblong, ½ mi. E	Comp.	110
Mallory & Crawford, Bradford, Pa.	Sec. 12-7-14, Crawford County	Comp.	100
Nolan & Lamberton, Box 1328, Tulsa, Okla.	Clark County	Comp.	124
	Clark County	Comp.	241
Ohio Oil Co., Casey	Cumberland County	Comp.	1,150
Ohio Oil Co., Casey	Cumberland County	Comp.	437
Ohio Oil Co., Casey	Crawford County	Comp.	405
Ohio Oil Co., Casey	Crawford County	Comp.	242
Ohio Oil Co., Oblong	Crawford County	Comp.	310
Ohio Oil Co., Oblong	Crawford County	Comp.	243
Ohio Oil Co., Robinson	Crawford County	Comp.	755
Ohio Oil Co., Hardinville	Crawford County	Comp.	100
Ohio Oil Co., Hardinville	Crawford County	Comp.	342
Ohio Oil Co., Oblong	Crawford County	Comp.	310
Ohio Oil Co., Stoy	Crawford County	Comp.	833
Ohio Oil Co., Stoy	Crawford County	Comp.	200
Ohio Oil Co., Oblong	Crawford County	Comp.	1,130
Ohio Oil Co., Oblong	Lawrence County	Comp.	570
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	575
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	1,800
Ohio Oil Co., Bridgeport			

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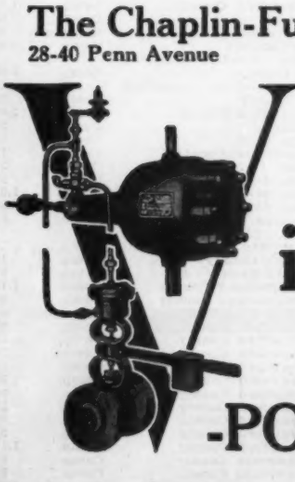


FULTON
Vigilant
-PORT VALVE

Company and plant address—	Field location—	Type of plant	Daily capy (gals.)
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	1,100
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	900
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	1,000
Ohio Oil Co., Lawrence	Lawrence County	Comp.	500
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	1,000
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	1,000
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	350
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	300
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	1,400
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	1,500
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	1,500
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	300
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	1,200
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	375
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	1,140
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	775
Ohio Oil Co., Bridgeport	Lawrence County	Comp.	450
Snowden & McSweeney Co., Bridgeport	E half SE, Sec. 17-3-12w	Topping	1,000
Splane, W. W., Oil City, Pa.	Robinson	Comp.	300
Stranahan & Cheuvront, 405 W. Main St., Oblong	Sec. 11-7-13	Comp.	15
Stranahan & Cheuvront, 405 W. Main St., Oblong	Sec. 22-6-13	Comp.	25
Stranahan & Cheuvront, 405 W. Main St., Oblong	Sec. 25-7-13	Comp.	20
Vacuum Gasoline Co., Lawrenceville	Lawrence County	Comp.	5,000
Vincennes Oil & Gas Co., Vincennes, Ind.	Lawrence County	Comp.	4,000
KANSAS			
Altitude Petroleum Co., Kennedy Bldg., Tulsa, Okla.	Chanute	Comp.	2,000
Barnsdall Oil Co., Route 2, Box 173, Oxford†	W half NW, Sec. 20-33-3	Absp.	20,000
Empire Oil & Refining Co., Caney	SW, Sec. 13-35-13	Absp.	*10,000
Empire Oil & Refining Co., Arkansas City	SE, Sec. 13-34-3	Absp.	*15,000
Empire Oil & Refining Co., Teterville	SW, Sec. 16-23-9	Absp.	10,000
Empire Oil & Refining Co., Madison	NW, Sec. 8-23-11	Absp.	9,000
Empire Oil & Refining Co., Thrall	SE half, Sec. 29-23-10	Comp.	7,500
Empire Oil & Refining Co., Wellington	SW, Sec. 17-32-1	Absp.	*12,000
Empire Oil & Refining Co., Madison	NE, Sec. 14-22-11	Comp.	4,500
Empire Oil & Refining Co., Wichita	NW, Sec. 17-28-1	Absp.	40,000
Kansas Gas & Gasoline Co., McPherson	K. P. L. trans. line	Absp.	20,000
Kansas Gas & Gasoline Co., Medicine Lodge	K. P. L. trans. line	Absp.	6,000
Kansas Gasoline Co., Box 1978, Tulsa, Okla.	Sec. 24-32s-4e, Cowley County	Absp.	5,000
McPherson Oil & Gas Development Co., United Life Bldg., Salina	SW, Sec. 29-18-2w	Absp.	10,000
Pep Gasoline Co.	Sedan, 2 mi. E	Comp.	1,200
Phillips Petroleum Co., Phillips Bldg., Bartlesville, Okla.	NE NW, Sec. 12-22-10	Comp.	6,000
Shell Petroleum Corp., Oxford	SE, Sec. 25-31s-2e	Absp.	5,000
Sinclair Prairie Oil Co., Box E, Kenbro	SW, Sec. 20-22-10e	Comp.	7,000
Skelly Oil Co., Box 236, Cunningham	Sec. 30-27s-10e, Kingman County	Absp.	2,500
Union Gasoline Co., Independence	S of Caney	Absp.	*2,000
Texas Co., The (Delaware), O'Brien Switch	Sec. 31-30n-6e	Absp.	12,400
Texas Co., The (Delaware), Gordon	Sec. 28-26n-5e	Absp.	6,000
Union Gasoline Co., Caney	Sec. 29-29-13, Washington County	Absp.	5,000
Washington Development Co., Wellington	Sec. 24-32s-1w	Absp.	*10,000

†Owned jointly with Continental Oil Co.

KENTUCKY			
Coast Oil Co., Monticello	Monticello	Comp.	*200
Heck, W. B., & Co., Box 164, Owensboro, Ky.	Monticello	Comp.	*300
Kentucky Pipe Line Co., 311 W. Chestnut St., Louisville	Clark County	Char.	2,000
Louisville Gas & Electric Co.	Winchester	Char.	2,500
Virginian Gasoline & Oil Co., Kermit, W. Va.	Martin County	Absp.	* 10,000
Virginian Gasoline & Oil Co., Catlettsburg	Boyd County	Absp.	24,000
LOUISIANA			
Arkansas Fuel Oil Co., Homer	Sec. 24-21n-8w, Claiborne	Comp.	5,000
Arkansas-Louisiana Pipe Line Co., Shreveport	Sec. 26-23n-16w	Absp.	*8,000
Century Carbon Co., Monroe	Ouachita Parish	Absp.	2,000
Century Carbon Co., Monroe	Richland Parish	Absp.	2,200
Columbian Gasoline Corp., R.F.D., Rayville	Sec. 10-16n-6e, Richland	Absp.	16,000
Columbian Gasoline Corp., Swartz	Sec. 5-18n-5e, Ouachita	Absp.	8,000
Columbian Gasoline Corp., Fairbanks	Sec. 37-19n-4e, Ouachita	Absp.	*4,000
Columbian Gasoline Corp., Fairbanks	Sec. 2-18n-4e, Ouachita	Absp.	8,000
Columbian Gasoline Corp., R.F.D. 2, Bastrop	Sec. 37-20n-5e, Morehouse	Absp.	*3,500
Columbian Gasoline Corp., R.F.D. 2, Bastrop	Sec. 19-29n-5e, Morehouse	Absp.	3,000
DeSota Gasoline Co.	Mansfield	Comp.	950
Gulf Refining Co. of Louisiana, Mooringsport	Caddo	Comp.	8,000
Gulf Refining Co. of Louisiana, Mooringsport	Homer	Absp.	10,000
Herkness, J. Smylie, R.F.D. 3, Bastrop	Morehouse Parish	Absp.	*1,000
Huber, J. M., Co. of Louisiana, Inc., Swartz	Sec. 5-18n-5e	Absp.	6,000
Louisiana Gas & Fuel Co.	Alto	Absp.	36,000
Louisiana Gas & Fuel Co.	Uscarco	Absp.	4,000
Louisiana Oil Refining Corp., Ardis Bldg., Shreveport	Sec. 28, Webster Parish	Absp.	*20,000
Magnolia Petroleum Co., Harmon	Sec. 12-12-11, Red River	Absp.	1,500
Magnolia Petroleum Co., Gilliam	Sec. 24-21n-15w, Caddo	Absp.	*1,300
Monroe-Louisiana Carbon Co., Swartz	Secs. 28 and 33-19n-5e Ouachita Parish	Char.	*2,000
Ohio Oil Co., Haynesville	Claiborne Parish	Absp.	4,000
Ohio Oil Co., Treat	Webster Parish	Absp.	2,000
Phillips Petroleum Co., Homer	W half SW, Sec. 19-21-7	Comp.	10,500
Reserve Natural Gas Co. of Louisiana, Shreveport	Sec. 10-17n-14w, Caddo	Absp.	*10,000
Rodessa Natural Gas Co., Shreveport	Shreveport	Absp.	*5,000
Southwestern Gas & Electric Co., Oil City	Oil City	Comp.	450
Standard Oil Co. of Louisiana, Trees	Caddo Field, near Trees	Absp.	7,000
Standard Oil Co. of Louisiana, Homer	Claiborne Field, near Homer	Absp.	8,500
Stanolind Oil & Gas Co., Gilliam	Gilliam	Absp.	6,000
Texas Company, The (Delaware), Oil City	Sec. 3-20n-16w, Caddo	Comp.	4,000
Texas Company, The (Delaware), Oil City	Sec. 23-21n-15w, Caddo	Absp.	*18,000
Texas Company, The (Delaware), Mooringsport	Sec. 19-20n-15w, Caddo	Comp.	*600
Texas Company, The (Delaware), Naborton	Sec. 34-13n-12w, De Soto	Comp.	*4,000
Union Gas Products, Inc., 710 Ouachita Bank Bldg., Monroe	Near Swartz	C-A	6,000
United Carbon Co., Monroe	Sec. 10-16-6	Absp.	9,000
United Carbon Co., Monroe	Sec. 5-18-5	Absp.	4,000
United Gas Public Service Co., Alto	Sec. 16-16n-6e, Richland	Absp.	50,000
United Gas Public Service Co., Bastrop	Sec. 31-20n-5e, Morehouse	Absp.	*1,300
United Gas Public Service Co., Cotton Valley	Sec. 21-21n-10w, Webster	Absp.	*20,000
United Gas Public Service Co., Cotton Valley	Sec. 17-21n-10w, Webster	Absp.	50,000
United Gas Public Service Co., Pine Island	Sec. 24-21n-15w, Caddo	Absp.	*3,000
United Gas Public Service Co., Sarepta	Sec. 30-22n-10w, Webster	Absp.	*12,000
United Gas Public Service Co., Swartz	Sec. 32-19n-5e, Ouachita	Absp.	*2,500
United Gas Public Service Co., Sugar Creek†	Sec. 6-19n-6e, Claiborne	Absp.	30,000

†Owned jointly with Sugar Creek Syndicate.

MONTANA			
Montana Power Gas Co., Cut Bank	Glacier County	Absp.	5,000
NEW MEXICO			
Phillips Petroleum Co., Hobbs	N. half NW, Sec. 4-19-38	Absp.	40,000
Shell Petroleum Corp., Hobbs†	SW, Sec. 19-18s-38e	Absp.	24,000

†Owned jointly with Continental Oil Co.

NEW YORK			
Empire Gas & Fuel Co., Andover	Lot 55, Andover Twp.	Absp.	*400
Wirt Gasoline Co., Bradford, Pa.	Richburg	Comp.	*500

OHIO

Company and plant address—	Field location—	Type of plant	Daily cap'y (gals.)
American Oil Development Co., Pittsburgh, Pa.	Monroe County	Comp.	500
American Oil Development Co., Pittsburgh, Pa.	Monroe County	Comp.	200
Hope Construction & Refining Co.	New Matamoras	Absp.	1,200
Jefferson Gasoline Co., Ryland	Sec. 27, Wells Twp.	Comp.	250
Muskingum Oil Co., Sistersville, W. Va.	Perry Twp., Monroe County	Comp.	*1,000
Norris, Mrs. Jennie, Parkersburg, W. Va.	Sec. 11, Newport Twp., Washington County	Comp.	100
Ohio Producing & Refining Co. (The)	Sec 22, Chippewa Twp., Wayne County	Char.	6,000
Preston Oil Co., Homer	Burlington Twp., Licking County	Absp.	15,000
Preston Oil Co., Pavonia	Weller Twp., Richland County	Absp.	40,000
Preston Oil Co., Sugar Grove	Berne Twp., Fairfield County	Absp.	90,000
Preston Oil Co., Caldwell	Caldwell	Absp.	3,000
Preston Oil Co., Pomeroy	Sutton Twp., Meigs County	Absp.	*5,000
Preston Oil Co., Zanesville	Wayne Twp., Muskingum County	Absp.	*2,000
Preston Oil Co., Medina	York Twp., Medina County	Absp.	*10,000
Reno Oil Co., Sistersville, W. Va.	Monroe County	Comp.	55
River Gas Co.	New Matamoras	Absp.	125
Southern Oil Co., Schley	Archers Fork	Comp.	200
Southern Oil Co., Southern Valley	Sycamore Valley	Comp.	200
Tuel & Thoenen	Fly, 2 mi. SW	Comp.	200
Tyler Oil Co., Sistersville, W. Va.	Monroe County	Comp.	41

OKLAHOMA

Akin Gasoline Co., Box 1402, Tulsa	Dewey	Comp.	1,000
Akin Gasoline Co., Box 1402, Tulsa	Bixby	Comp.	1,000
Altitude Petroleum Corp., Kennedy Bldg., Tulsa	Oilton	Comp.	*5,000
Amerada Petroleum Corp., Box 596, Ardmore	W half SE, Sec. 20-5s-1e	Comp.	*5,000
Amerada Petroleum Corp., Box 686, Healdton	SE, Sec. 31-2s-2w	Absp.	12,000
Amerada Petroleum Corp., Box 92, Earlsboro	Sec. 16-9n-5e	Absp.	*15,000
Amerada Petroleum Corp., Harjo	N half W half NE, Sec. 7-8n-5e	Absp.	35,000
Amerada Petroleum Corp., Box 92, Earlsboro	SW NW, Sec. 17-9n-5e	Comp.	*15,000
Amerada Petroleum Corp., R.F.D. 8, Oklahoma City	SE, Sec. 30-11n-2w	Absp.	15,000
Barco Gasoline Co., Wirt	Healdton Field	Comp.	3,000
Barnsdall Oil Co., Box 224, Avant	SE, Sec. 18-23-12	Absp.	2,000
Barnsdall Oil Co., Box 518, Earlsboro	NE NE, Sec. 15-9-5	Absp.	5,000
Barnsdall Oil Co., Box 2039, Tulsa	SE, Sec. 5-20-12	Absp.	600
Barnsdall Oil Co., Route 1, Barnsdall	NW, Sec. 29-25-11	Absp.	1,800
Barnsdall Oil Co., Box 228, Osage	SW, Sec. 20-21-9	Absp.	1,600
Barnsdall Oil Co., Box 856, Beggs	NE, Sec. 6-14-12	Absp.	2,000
Bartlett Gasoline Co., 313 Wright Bldg., Tulsa	Sec. 23-14-19	Absp.	11,000
Carter Oil Co., Box 801, Tulsa	Sec. 23-4s-2w	Absp.	6,000
Carter Oil Co., Box 801, Tulsa	Sec. 9-26n-6e	Absp.	12,000
Carter Oil Co., Box 801, Tulsa	Sec. 3-10n-8e	Absp.	16,000
Carter Oil Co., Box 801, Tulsa	Sec. 15-9n-6e	Absp.	50,000
Carter Oil Co., Box 801, Tulsa	Sec. 14-7n-6e	Absp.	15,000
Celine Gasoline Corp., Oklahoma City	Sec. 24-11n-3w, Oklahoma City	Absp.	25,000
Comar Gasoline Co., Tonkawa	NE, Sec. 2-24n-1w	Absp.	30,000
Comar Oil Co., Blackwell	SW, Sec. 21-29n-1w	Absp.	10,000
Comar Oil Co., Blackwell	NW, Sec. 5-28n-1w	Absp.	10,000
Cosden, J. S., Inc., Fort Worth, Tex.	Sec. 21-19n-4w	Absp.	*50,000
Cosden, J. S., Inc., Fort Worth, Tex.	Sec. 19-11n-11e	Comp.	1,000
Cromwell-Franklin Oil Co., Oklahoma City	SE SW SE, Sec. 12-11n-3w	Absp.	30,000
Crosbie, Inc. (J. E.), Box 715, Earlsboro	NE NE, Sec. 9-9-5	Absp.	*16,000
Crosbie, Inc. (J. E.), Lovell	NW, Sec. 20-19-4	Comp.	20,000
Crosbie, Inc. (J. E.), Okemah	Sec. 29-12-10	Absp.	16,000
Crosbie, Inc. (J. E.), Box 84, Pearson	S½ S½ NE, Sec. 15-7-4	Absp.	20,000
Crosbie, Inc. (J. E.), Holdenville	NW NW, Sec. 15-7-8	Absp.	20,000
Crosbie, Porter & Martin, Box 625, Okemah	SW SE, Sec. 29-12-10	Absp.	16,000
Deep Rock Oil Corp., Shamrock	Sec. 4-16-7	Absp.	5,000
Deep Rock Oil Corp., Kellyville	Sec. 17-17-11	Comp.	4,000
Deep Rock Oil Corp., Mehan	Sec. 23-18-3	Absp.	8,000
Deep Rock Oil Corp., Cushing	Sec. 9-18-10	Absp.	4,000
De Soto Gasoline Co., Muskogee	Sec. 5-14-18	Comp.	366
Devonian Oil Co., Tulsa, Okla.	NE, Sec. 32-7n-6w	Absp.	*10,000
Devonian Oil Co., Tulsa, Okla.	SE, Sec. 22-17n-10e	Absp.	20,000
Eagle-Picher Mining & Smelting Co., Henryetta, Okla.	Sec. 6-11n-13e	Absp.	3,000
Eason Oil Co., Enid	NE, 24-22-4w	Comp.	2,000
Eason Oil Co., Enid	SW, 34-17-4w	C-A	12,000
Empire Oil & Refining Co., Tallant	SE, Sec. 35-25-10	Absp.	20,000
Empire Oil & Refining Co., Seminole	SE, Sec. 24-9-6	Absp.	25,000
Empire Oil & Refining Co., Seminole	NE, Sec. 34-9-6	Absp.	*20,000
Empire Oil & Refining Co., Seminole	SW, Sec. 14-8-6	C-A	20,000
Empire Oil & Refining Co., Seminole	NE, Sec. 11-8-5	Comp.	25,000
Empire Oil & Refining Co., Konawa	NW, Sec. 9-6-6	Absp.	20,000
Empire Oil & Refining Co., Konawa	NE, Sec. 22-6-3	Absp.	*10,000
Empire Oil & Refining Co., Asher	NE, Sec. 29-6-6	Absp.	30,000
Enfisco Oil Corp., Box 2021, Tulsa	NE, Sec. 17-17-13, Bixby	Comp.	1,500
Foster & Norwood Oil Co., Bartlesville	Barnsdall	Absp.	4,900
Franklin, Wirt, Petroleum Corp., Cromwell-Franklin and I.T.I.O. Co., Oklahoma City	NW NW, Sec. 12-11n-3w	Absp.	25,000
Grimes, O. L., and Park T., Box 1175, Tulsa	Sec. 35-20-9	Comp.	1,000
Grimes, Otha H., and Roy O. Neal, Drumright	Sec. 17-17-7, Creek County	Absp.	3,400
Grimes Gasoline Co., Tulsa	Okemah	Absp.	5,000
Grimes Gasoline Co., Tulsa	Keystone	Absp.	4,000
Grimes, O. H. and P. W., Tulsa	Weleetka	Comp.	2,000
Grimes, C. W. and O. H., Tulsa	Weleetka	Absp.	6,000
Gypsy Oil Co., Box J, Kiefer	N half SW, Sec. 16-17-12	Comp.	12,500
Gypsy Oil Co., Box 128, Drumright	E half NE, Sec. 5-17-7	Comp.	*3,300
Gypsy Oil Co., Box 128, Drumright	NE SW, Sec. 10-16-7	Comp.	*2,400
Gypsy Oil Co., Box 338, Cleveland	SE, Sec. 1-21-7	Comp.	2,400
Gypsy Oil Co., Route 2, Kaw City	NW, Sec. 24-27-5e	Absp.	12,000
Gypsy Oil Co., Box 1513, Three Sands	NW, Sec. 2-24-1w	Absp.	*4,900
Gypsy Oil Co., Box 128, Drumright	NE, Sec. 3-14-2e	Absp.	2,600
Gypsy Oil Co., Box 128, Drumright	NW, Sec. 11-14n-5e	Absp.	*3,500
Gypsy Oil Co., Box 967, Seminole	SE SW, Sec. 14-7n-6e	Absp.	8,000
Gypsy Oil Co., Box 967, Seminole	SE NW, Sec. 7-8-6e	Absp.	15,000
Harland Oil Co., Wolco, Okla.	SW, Sec. 20-25-11	Absp.	1,500
Harland Oil Co., Wolco, Okla.	NE, Sec. 25-24-11	Absp.	1,500
Indian Territory Illuminating Oil Co., Oklahoma City	SE, Sec. 24-11-3	Absp.	25,000
Indian Territory Illuminating Oil Co., Oklahoma City	SW, Sec. 19-11-2	Absp.	25,000
Indian Territory Illuminating Oil Co., Oklahoma City	SE, Sec. 13-11-3	Absp.	25,000
Indian Territory Illuminating Oil Co., Oklahoma City	NW, Sec. 31-11-2	Absp.	25,000
Indian Territory Illuminating Oil Co., Oklahoma City	SE, Sec. 11-11-2	Absp.	25,000
Indian Territory Illuminating Oil Co., Oklahoma City	Sec. 12-11-3	Absp.	25,000
Lebow (C. H.), Drumright	Sec. 8-17n-7e	Absp.	1,800
Magnolia Petroleum Co., Yale	NE SW, Sec. 6-19n-6e	Absp.	4,500
Magnolia Petroleum Co., Oilton	NE, Sec. 7-18n-7e	Absp.	9,500
Magnolia Petroleum Co., Shamrock	SW, Sec. 3-16n-7e	Absp.	8,250
Magnolia Petroleum Co., Davenport	SW, Sec. 34-15n-5e	Absp.	3,750
Magnolia Petroleum Co., Earlsboro	NE NW SE, Sec. 10-9n-5e	Absp.	*6,000
Magnolia Petroleum Co., St. Louis	NW SW SE, Sec. 15-7n-4e	Absp.	13,000
Magnolia Petroleum Co., Wewoka	W 7.65 ac., Lot 4, Sec. 32-8n-8e	Absp.	5,750
Magnolia Petroleum Co., Duncan	NW NW, Sec. 19-1s-8w	Comp.	*600
Magnolia Petroleum Co., Graham	SE SE SE, Sec. 23-2s-3w	Absp.	5,000
Magnolia Petroleum Co., Healdton	SW NW NE, Sec. 15-4s-2w	Absp.	*2,500
Masoneal Gasoline Co., Box 516, Tulsa	Sec. 23-21n-8e	Comp.	1,500
McBride, Inc., W. C., St. Louis, Mo.	Osage County	Comp.	1,500
Midco Oil Corp., Tulsa	Billings, 8 mi. S	Comp.	*20,000
Midco Oil Corp., Tulsa	Dewey	Comp.	*10,000

SEE the New

McCord Class "SF"

Liquid Sight Feed Lubricator

An Outstanding Development

by the Makers of the

"Standard Lubricator of the Oil Fields"

Booths 71 - 72

OKLAHOMA BUILDING

International Petroleum Exposition

McCord - Detroit

GRAVER

FABRICATORS TO THE OIL INDUSTRY

FIELD STORAGE and REFINERY EQUIPMENT

The engineering department of GRAVER offers you expert service in modern economies of design and erection. We are equipped to build and erect field storage, refinery, bulk plant, service station and truck tank equipment of steel plate construction with necessary fittings, either to your specifications or designed to your needs. GRAVER manufacturing and fabricating facilities are unexcelled, yet production costs are low. GRAVER experience and responsibility are long standing. GRAVER field erection is recognized for its good workmanship. Let GRAVER figure on your work.

GRAVER TANK & MFG. CORP.

General Sales Office: 332 South Michigan Avenue, Chicago.
General Offices and Factory: East Chicago, Indiana. *Rep. in Principal Cities*

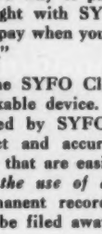
Nearly 75 Years in Steel Plate Fabrication

You can't put a crooked **HOLE** *in jail*

A crooked hole *picks your pockets* . . . cuts down your profits, pushes up your costs. And *you* have to take the punishment. That's why it pays to keep holes straight with SYFO. That's why *you* pay when you "play along with luck."

The SYFO Clinograph is a remarkable device. The records afforded by SYFO Clinograph are direct and accurate records—records that are easily obtained *without the use of dangerous acids*—permanent records on paper that can be filed away for reference.

Write for descriptive literature and rates. Also operators of the Surwel Clinograph.



See Our Exhibit in the Scientific & Technical Building Space No. 14

Sectional view of a SYFO Clinograph

Cross Section view of "Go-Devil" Spring Shock Absorber Type.

SPERRY-SUN WELL SURVEYING CO.

1608 Walnut Street
PHILADELPHIA, PA.
DALLAS, TEXAS
1501 Munger Avenue
TULSA, OKLAHOMA
402 Petroleum Bldg.
TYLER, TEXAS
Peoples Nat'l. Bank Bldg.
HOUSTON, TEXAS
819 Esperson Bldg.
LOS ANGELES, CALIF.
415 Petroleum Securities Bldg.
BRADFORD, PA.
Hooker Fulton Bldg.

SYFO CLINOGRAPH

Company and plant address—	Field location—	Type of plant	Daily cap'y (gals.)
Midco Oil Corp., Tulsa	Drumright	Comp.	5,000
Midco Oil Corp., Tulsa	Oilton	Comp.	16,000
Mid-Continent Petroleum Corp., Tulsa	SE SE, Sec. 22-17-7	Absp.	20,000
Mid-Continent Petroleum Corp., Tulsa	E half NW, Sec. 5-16-15	Comp.	3,000
Mid-Continent Petroleum Corp., Tulsa†	SE, Sec. 13-22-4w	Absp.	25,000
Mid-Continent Petroleum Corp., Tulsa	SW, Sec. 12-13-13	Absp.	2,000
Mid-Continent Petroleum Corp., Tulsa	NE SW, Sec. 15-10-8	Absp.	5,000
Mid-Continent Petroleum Corp., Tulsa	S half SE, Sec. 28-17-14	Comp.	2,000
Mid-Continent Petroleum Corp., Tulsa	W half NW, Sec. 17-9-8	Absp.	5,000
Mid-Continent Petroleum Corp., Tulsa	NW, Sec. 8-15-6	Absp.	2,000
Mid-Continent Petroleum Corp., Tulsa	NW, Sec. 28-20-12	Absp.	2,000
Mid-Kansas Oil & Gas Co., Thompson Bldg., Tulsa	Sec. 27-16-9, Creek County	C-A	5,000
Moon Gasoline Co., Tulsa	Sec. 32-15-13	Comp.	500
Moon Gasoline Co., Tulsa	Sec. 4-16-13	Comp.	1,500
National Products Co., 1510 Commonwealth Bldg., Pittsburgh, Pa.	Oilton	Absp.	1,200
National Products Co., 1510 Commonwealth Bldg., Pittsburgh, Pa.	Slick	Absp.	1,200
National Products Co., 1510 Commonwealth Bldg., Pittsburgh, Pa.	Slick	Absp.	1,600
National Products Co., 1510 Commonwealth Bldg., Pittsburgh, Pa.	Slick	Absp.	1,400
Neal Gasoline Co., Osage	Sec. 13-21-8	Absp.	4,000
Neal Gasoline Co., Copan	Sec. 32-28-13	Absp.	*1,200
Oil State Gasoline Co.	NE, Sec. 7-18n-13e	Comp.	2,500
Oil State Gasoline Co., Jenks	NE, Sec. 13-19n-8e	Comp.	2,000
Oklahoma Gasoline Plants, Inc., Drumright	Sec. 18-18-7e	Absp.	10,000
Orfic Gasoline Production Co., Tulsa	Cleveland	Comp.	2,000
Peppers Gasoline Co., Enid	Enid	Absp.	5,000
Phillips Petroleum Co., Bartlesville	NW SW, Sec. 32-11-2w	Absp.	50,000
Phillips Petroleum Co., Bartlesville	NW SW, Sec. 33-11-8	Absp.	20,000
Phillips Petroleum Co., Bartlesville	NE NE, Sec. 26-27-5	Absp.	45,000
Phillips Petroleum Co., Bartlesville	SE NW, Sec. 24-11-11	Absp.	17,000
Phillips Petroleum Co., Bartlesville	NW NW, Sec. 23-7-6	Absp.	15,000
Phillips Petroleum Co., Bartlesville	S half, Sec. 1-11-3	Absp.	60,000
Phillips Petroleum Co., Bartlesville	SW NW, Sec. 12-25-11	Absp.	5,000
Phillips Petroleum Co., Bartlesville	SE SE, Sec. 6-24-10	Absp.	14,000
Phillips Petroleum Co., Bartlesville	SW NW, Sec. 33-8-8	Absp.	50,000
Phillips Petroleum Co., Bartlesville	N half NW, Sec. 3-9-9	Absp.	30,000
Powers, M. F., Depew	Sec. 8-15-8	Absp.	3,500
Powers & Quinlan, Box 696, Beggs	SW NE, Sec. 11-14-12	Comp.	1,000
Powers & Quinlan, Box 696, Beggs	SW SE, Sec. 5-14-12	Comp.	500
Powers & Quinlan, Box 696, Beggs	Sec. 22-13-14	Comp.	500
Pure Oil Co., Drumright	Sec. 32-18n-7e	Comp.	3,100
Pure Oil Co., Oilton	Sec. 32-19n-7e	Comp.	1,700
Pure Oil Co., Healdton	Sec. 11-4s-3w	Comp.	1,000
Pure Oil Co., Depew	Sec. 5-15n-8e	Comp.	1,400
Pure Oil Co., Seminole	Sec. 26-9n-6e	Comp.	5,000
Reserve Petroleum Co., Box 338, Barnsdall	Barnsdall	Absp.	2,500
Sand Springs Home, Gasoline Department, Sand Springs	Sec. 4-18-7	Comp.	*3,000
Shell Petroleum Corp., Three Sands	NW, Sec. 2-24n-1w	Absp.	10,000
Shell Petroleum Corp., Braman	SW, Sec. 21-29n-1w	Absp.	8,000
Shell Petroleum Corp., Braman	NW, Sec. 5-28n-1w	Absp.	4,000
Shell Petroleum Corp., Drumright	NE, Sec. 8-17n-7e	Absp.	8,000
Shell Petroleum Corp., Maud	SE, Sec. 7-8n-5e†	Absp.	7,000
Shell Petroleum Corp., Marshall	SE, Sec. 19-19n-4w	Absp.	12,000
Signal Oil & Gas Co., Inc.	Bristow	Absp.	5,000
Silurian Oil Co., Missouri Pacific Bldg., St. Louis	Avant	Comp.	1,200
Sinclair Prairie Oil Co., Box 68, Cleveland	S half SW, Sec. 35-21-8	Comp.	4,000
Sinclair Prairie Oil Co., R.F.D. 1, Drumright	SW SW, Sec. 28-18-7	Comp.	9,009
Sinclair Prairie Oil Co., Box 578, Shamrock	SW SE, Sec. 28-17-7	Comp.	12,000
Sinclair Prairie Oil Co., Box 368, Covington	W half SW, Sec. 19-22-3	Absp.	20,000
Sinclair Prairie Oil Co., Box 6, Shidler	SW SE, Sec. 29-27-6	Absp.	30,000
Sinclair Prairie Oil Co., Box 865, Seminole	NW NW, Sec. 35-9-6	Absp.	70,000
Sinclair Prairie Oil Co., Box 787, Seminole	SW NE, Sec. 10-8-6	Absp.	50,000
Sinclair Prairie Oil Co., St. Louis	SW, Sec. 24-7-4	Comp.	30,000
Sinclair Prairie Oil Co., Box 4188, Capitol Hill, Oklahoma City	SE NW, Sec. 30-11-2	Absp.	50,000
Sinclair Prairie Oil Co., Box 297, Sasakwa	W half, Sec. 7-6-8	Comp.	20,000
Skelly Oil Co., Box 536, Seminole	SW, Sec. 17-9n-6e	Absp.	11,000
Skelly Oil Co., Box 157, Lyman	NW, Sec. 11-27n-5e	Absp.	6,000
Skelly Oil Co., Jennings	NW SW NW, Sec. 15-20n-5e	Absp.	2,750
Skelly Oil Co., Box 168, Slick	NW cor., Sec. 15-15n-10e	Absp.	3,000
Skelly Oil Co., Box 413, Wynona	N half SW, Sec. 24-24n-9e, Osage County	Absp.	4,000
Southland Gasoline Co., Tulsa	Sec. 33-19-7, Creek County	Absp.	2,000
Southwest Production Co., Bristow	Sec. 20-16-9, Creek County	Comp.	2,000
Stanolind Oil & Gas Co., 910 S. Michigan Ave., Chicago, Ill.	Drumright	Comp.	30,000
Stanolind Oil & Gas Co., 910 S. Michigan Ave., Chicago, Ill.	Tonkawa	Absp.	10,000
Sterling Oil & Gas Co., Tulsa	SE, Sec. 1-21-11	Absp.	250
Superior Oil Corp., 315 Exchange Natl. Bank Bldg., Tulsa	NE, Sec. 2-9n-5e	Comp.	*10,000
Superior Oil Corp., 315 Exchange Natl. Bank Bldg., Tulsa	NW, Sec. 3-9-5	Comp.	*10,000
Test Oil Co., Bartlesville	Sec. 30-27-14	Comp.	*500
Texas Company, The (Delaware), Kiefer	Sec. 8-17n-12e	Comp.	13,900
Texas Company, The (Delaware), Haskell	Sec. 22-15n-14e	Comp.	*6,800
Texas Company, The (Delaware), Davenport	Sec. 2-14n-5e	Absp.	12,200
Texas Company, The (Delaware), McInnis	Sec. 30-25n-8e	Absp.	5,000
Texas Company, The (Delaware), Maude	Sec. 7-8n-5e†	Absp.	25,000
Tide Water Oil Co. (Okla.), Philcade Bldg., Tulsa	Sec. 8-17n-7e	Absp.	15,000
Victor Gasoline Co., Stroud	Sec. 5-15-6	Absp.	5,000
Victor Gasoline Co., Bristow	Sec. 27-16-9	Absp.	5,000
Victor Gasoline Co., Bristow	Sec. 8-16-8	Comp.	1,000
Warner-Caldwell Oil Co., Titusville, Pa.	Sec. 36-26n-14e	Comp.	200
Warner-Caldwell Oil Co., Titusville, Pa.	Sec. 1-25n-16e	Comp.	1,000
Warner-Caldwell Oil Co., Titusville, Pa.	Sec. 17-26n-16e	Comp.	400
Warner-Caldwell Oil Co., Titusville, Pa.	Sec. 17-18n-26e	Comp.	3,000
Wentz, L. H., Oil Division, Ponca City	Sec. 34-25n-1w	Absp.	2,000
Wentz, L. H., Oil Division, Ponca City	Sec. 17-28n-1e	Absp.	2,500
Western Gasoline Corp., Box 198, Tulsa	Sec. 34-17n-10e	Absp.	4,500
Westoak Gasoline Co., Box 507, Sayre	SE SW, Sec. 21-9-23w	Absp.	10,900
Wilcox, H. F., Oil & Gas Co., Tulsa	Sec. 5-8-8	Absp.	2,500
Wirt Franklin Petroleum Corp., Ardmore	NW, Sec. 12-11n-3w	Absp.	20,000
Wiser Oil Co., Bartlesville	Sec. 31-25-17e	Comp.	2,000
Wolverine Petroleum Corp., Avant	E half, Sec. 24-24n-11e	Absp.	7,500
Wolverine Petroleum Corp., Bartlesville	SE, Sec. 13-26n-12e	Comp.	2,000
Wolverine Petroleum Corp., Dillard	SW, Sec. 22-4s-2w	Absp.	9,000
Wright, J. H., estate, Sapulpa	Kellyville	Absp.	4,500

†Owned jointly with Continental Oil Co. ‡Owned jointly with The Texas Company.
§Plant owned jointly with Sinclair Oil & Gas Co.

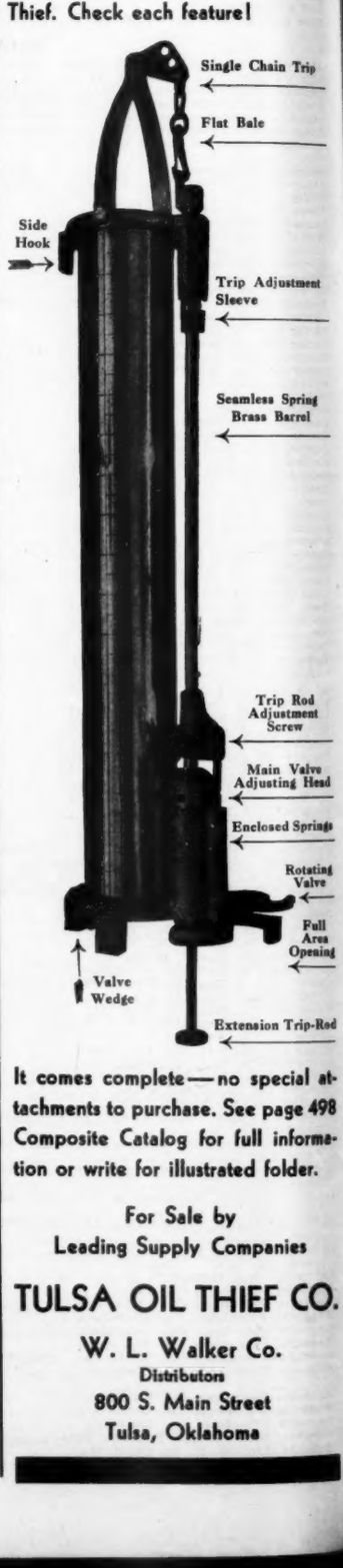
PENNSYLVANIA

Alum Rock Gas Co., Oil City	Fern	Comp.	200
Atlas Oil Co., Clarion	Near Tylersburg	Comp.	350
Barbary & Hardt	Wildwood	Comp.	11
Bartoe, Harry T., Petrolia	Petrolia	Comp.	25
Bayliss & Fasenmeyer	Titusville, 2 mi. S	Comp.	1,000
Berry, Pryor	Petrolia	Comp.	25
Brown, Clara L.	Kinzua	Comp.	100
Buzard Gas Co., Emlenton	Emlenton, 1 mi. E	Comp.	50
Carnahan, Charles E., and Lida M.	Tidioute, ½ mi. W	Comp.	500
Carnegie Natural Gas Co., Lone Pine	Washington County	Absp.	1,000
Carnegie Natural Gas Co.	Mount Morris	Absp.	200
Carnegie Natural Gas Co., Waynesburg	Greene County	Absp.	4,500
Carpenter, M. A., Karns City	Fairview Twp.	Comp.	200
Chambers Oil Co.	.....	Comp.	150
Christie & Timblin	Evans City	Comp.	*25
Clinger Oil & Gas Co., Tidioute	Fagundus	Comp.	500

BELIEVE IT OR NOT—

This THIEF will save you money!

Gaugers have stamped their approval on this greatly improved Tulsa Oil Thief. Check each feature!



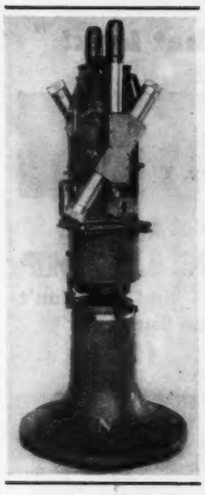
It comes complete—no special attachments to purchase. See page 498 Composite Catalog for full information or write for illustrated folder.

For Sale by Leading Supply Companies

TULSA OIL THIEF CO.

W. L. Walker Co.
Distributors
800 S. Main Street
Tulsa, Oklahoma

Company and plant address—	Field location—	Type of plant	Daily cap'y (gals.)
Clinger Oil & Gas Co., Tidioute	Hastings Bridge	Comp.	500
Cochran, John G., Sheffield	Lot 428, Sheffield Twp.	Absp.	1,100
Coffin, C. J., Chicora	Karns City	Comp.	85
Coffin, C. J., Chicora	Chicora	Comp.	85
Columbia Gas & Elec. Corp., McKinley	Elk County	Absp.	1,500
Columbia Gas & Elec. Corp., Majorville	West Twp.	Absp.	7,080
Columbia Gas & Elec. Corp., Waynesville	Franklin Twp.	Absp.	3,930
Columbia Gas & Elec. Corp., Heard	Finley Twp., West County	Absp.	2,550
Conquer, S. J.	Sheffield	Comp.	*80
Cook Oil Lease, Kelletville	Mayburg	Comp.	300
Daugherty, C. R., Y.M.C.A. Bldg., Butler	Herman, Butler County	Comp.	25
Daugherty, C. R. and M. G., Y.M.C.A. Bldg., Butler	Petrolia, Butler County	Comp.	25
Daugherty, C. R., & Co., Y.M.C.A. Bldg., Butler	Oakdale, Allegany County	Comp.	75
Dempseytown Gas Co., Oil City	Leeper	Comp.	200
Dempseytown Gas Co., Oil City	Shippenville	Comp.	100
Dunlap, Harry G., Chicora	Chicora, 1 mi. W	Comp.	11
Edwards, E. A., Titusville	Titusville	Comp.	170
Elsworth, Hefron & Co.	Lucinda	Comp.	400
Ellenberger, W. J., & Sons	.....	Comp.	300
Elliott Bros.	Chicora	Comp.	500
Equitable Gas Co., Rogersville	¼ mi. E of Rogersville	Absp.	10,000
Equitable Gas Co., R.F.D. 1, Clarksburg, Pa.	Near Zollersville	Absp.	2,000
Federal Oil & Gas Co., McDonald	McDonald	Comp.	100
Fleming, J. E., Titusville	Grand Valley	Comp.	500
Forest Chemical Co., Sheffield	Warren County, Sheffield Twp.	Absp.	500
Forest Oil & Gas Co., Clinton	Clinton, 3 mi. N	Comp.	300
Gamble, James	Karns City, 1½ mi. E	Comp.	75
Gould, Nancy E., & Son, R.F.D. 6, Butler	Penn Twp.	Comp.	6
Hadden, James B., Sheffield	Henry's Mill	Comp.	84
Hague & Co.	Tidioute	Comp.	500
Haskell & Bayliss	Emlenton, 4 mi. E	Comp.	150
Haskell Bros., Pleasantville	Southwest Twp., Warren County	Comp.	50
Haskell, Roth & Bayliss, Tidioute	Triumph Twp., Warren County	Comp.	400
Hickey & Rieg, Clarendon	Henry's Mill	Comp.	300
Home Gas Co., Clarion	Highland Twp.	Comp.	.....
Hope Construction & Refining Co.	Bravo	Absp.	20,000
Hope Construction & Refining Co.	Imperial	Char.	3,600
Hope Construction & Refining Co.	McKeesport	Char.	*2,600
Hope Construction & Refining Co.	Mayport	Absp.	1,500
Hope Construction & Refining Co.	Yatesboro	Absp.	*900
Hunter, Livingston L. Trust, Tidioute	Forrestville, Forrest County	Comp.	*200
Jackson, Fred W.	Chicora	Comp.	360
Jennings, E. H., Bros. Co., 608 Columbia Bldg., Pittsburgh	Fayette Twp. Allegheny County	Comp.	1,000
Jennings, E. H., Bros. Co., 608 Columbia Bldg., Pittsburgh	Fayette Twp., Allegheny County	Comp.	150
Johnson, C. H., and H. G. Dunlap	Chicora	Comp.	60
Kapp & Brocklehurst, Tidioute	Tidioute	Comp	200
McKeekin, Chas. T., Karns City	Karns City, 1½ mi. SW	Comp.	50
Mars Oil Co. (The), Oil City	Endeavor	C-A	*1,200
Mars Oil Co. (The), Oil City	Lewis Run	C-A	6,504
Mars Oil Co. (The), Oil City	So. Oil City	C-A	4,000
Mars Oil Co. (The), Oil City	Van	C-A	7,500
Mars Oil Co. (The)	Clarion	C-A	*1,800
Master & Hess, Inc.	Fern, 1 mi. W	Comp.	100
Midland Oil Co., Petroleum Center	Petroleum Center	Comp.	1,200
Montgomery, James, R.F.D. 1, McCoy Road	McKee's Rocks	Comp.	100
Moore, Way & Harrison	Titusville, 7 mi. N	Comp.	150
Myers Bros. & Hazzard	Tidioute, 1 mi. N	Comp.	100
National Gasoline Co.	Grand Valley	Comp.	250
National Gasoline Co.	West Hickory	Comp.	250
North Penn Gas Co., 103 Mill St., Port Allegany	Shinglehouse	Absp.	*600
O'Hara, Sarah C., 218 E. North St., Butler	Fairview Twp.	Comp.	100
Pennsylvania Fuel Supply Co.	Clarion	C-A	*800
Pennsylvania Oil Co.	Sheffield	C-A	10,000
Porter Bros., Catfish	Catfish, 1 mi. E	Comp.	100
President Oil Co., Emlenton	Bruin, 2 mi. W	Comp.	50
President Oil Co., Emlenton	Emlenton, 2 mi. SW	Comp.	150
President Oil Co., Emlenton	Fryburg, 6 mi. N	Comp.	500
Price, Harry D., Renfrew	Butler Twp., Butler County	Comp.	35
Ramage, S. Y., Oil City	Venango County	Comp.	100
Ramage, S. Y., Oil City	Warren County	Comp.	50
Red Brush Oil Co., Tidioute	6 mi. S Tionesta	Comp.	40
Riddle Farm Oil Co., Karns City	¼ mi. S Karns City	Comp.	50
Ritzert Bros., Chicora	Chicora	Comp.	70
Sand Hill Lease, Tidioute	Perry Twp., Armstrong	Comp.	100
Say, George K., R.F.D. 2, Karns City	Triumph Twp., Warren County	Comp.	40
Sloan & Zook Co., Kane	Kane	Absp.	1,500
Southern Oil Co., 1005 Farmers Bank Bldg., Pittsburgh	Miola	Comp.	100
Southern Oil Co., 1005 Farmers Bank Bldg., Pittsburgh	Pleasantville	Comp.	*25
Southern Oil Co., 1005 Farmers Bank Bldg., Pittsburgh	Clarion	Comp.	100
South Penn Oil Co., Pittsburgh	Evans City	Comp.	150
South Penn Oil Co., Pittsburgh	Badon	Comp.	50
South Penn Oil Co., Pittsburgh	Bradford	Comp.	550
South Penn Oil Co., Pittsburgh	South Heights	Comp.	550
South Penn Oil Co., Pittsburgh	Campbell	Comp.	150
South Penn Oil Co., Pittsburgh	Evans City	Comp.	450
South Penn Oil Co., Pittsburgh	Guffey	Comp.	150
South Penn Oil Co., Pittsburgh	Henry's Mill	Comp.	300
South Penn Oil Co., Pittsburgh	Kane	Comp.	100
South Penn Oil Co., Pittsburgh	Wright	Comp.	550
South Penn Oil Co., Pittsburgh	New Freeport	Absp.	1,000
South Penn Oil Co., Pittsburgh	Noblestown	Comp.	1,600
South Penn Oil Co., Pittsburgh	Evans City	Comp.	125
South Penn Oil Co., Pittsburgh	Parker's Landing	Comp.	80
South Penn Oil Co., Pittsburgh	President	Comp.	500
South Penn Oil Co., Pittsburgh	Tiona	Comp.	450
South Penn Oil Co., Pittsburgh	Porkey	Comp.	650
South Penn Oil Co., Pittsburgh	Sturgeon	Comp.	1,500
South Penn Oil Co., Pittsburgh	Noblestown	Comp.	125
Stephens, W. J., Grand Valley	Grand Valley	Comp.	100
Success Oil Co., Titusville	Pioneer	Comp.	2,000
Surety Oil Co., Inc., Titusville	2½ mi. S Titusville	Comp.	1,000
Tarbell & Co., Grand Valley	2 mi. from Grand Valley	Comp.	80
Thomas, R. L., Tidioute	Middle Field	Vac.	250
Tompsett Bros., Tidioute	Triumph Twp.	Comp.	500
Triangle Co., McKees Rocks	Pine Hollow Road	Comp.	350
Triumph Petroleum Co., Route 3, Tidioute	Triumph Twp., Warren County	Comp.	175
Vogebacker, A. J. and J. E.	Lucinda	Comp.	42
Wahl, A. R., Evans City	Wahl farm, Forward Twp.	Comp.	150
Warner-Caldwell Oil Co., R.F.D. 2, Titusville	Titusville	Comp.	1,000
Wheeler, D. H., Box 86, Petrolia	Petrolia, 1½ mi. SE	Comp.	200
Will, Jacob W., McDonald	Canonsburg	Comp.	55
TEXAS			
Airolene Gasoline Corp., Kennedy Bldg., Tulsa, Okla.	Sec. 9, Blk. 27, Magic City R.R. Sur.	Absp.	8,000
Amerada Petroleum Corp., Drawer C, Fry	Chas. Betts Sur. No. 625, Brown County	Absp.	20,000
American Natural Gasoline Co., Ramsdell	Sec. 100, Blk. 3, H.&G.N. Sur.	Absp.	40,000
Arab Gasoline Corp., Eastland	SE, Sec. 17, Blk. 4, H.& T.C. Ry. Sur.	Absp.	25,000



NEW

ASKANIA TORSION BALANCE

WITH SHORT PERIOD OF OBSERVATION

This instrument will be of particular interest to those who need a light and dependable balance for fast surveys and who prefer to check geophysical data obtained with other geophysical methods with a speedy and economical Torsion Balance for fast, one-man operation.

Write us for further details.

AMERICAN ASKANIA CORPORATION

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INVITING YOU—

to visit the Wackman Display of Steel Barrels and Drums.

INTERNATIONAL PETROLEUM EXPOSITION

BOOTH No. 42

Refiners & Marketers Bldg.

TULSA, OKLAHOMA

MAY 12-19

The Wackman exhibit will be of interest and value to every refiner and marketer. Here you will see displayed steel drums of standard sizes and styles, as well as newly designed drums, which strikingly reflect the Wackman policy of continual endeavor to maintain the manufacture of steel containers on a high plane of skilled engineering craftsmanship.

WACKMAN WELDED WARE COMPANY

General Offices—7th & Victor Streets—St. Louis, Mo.

FACTORIES:

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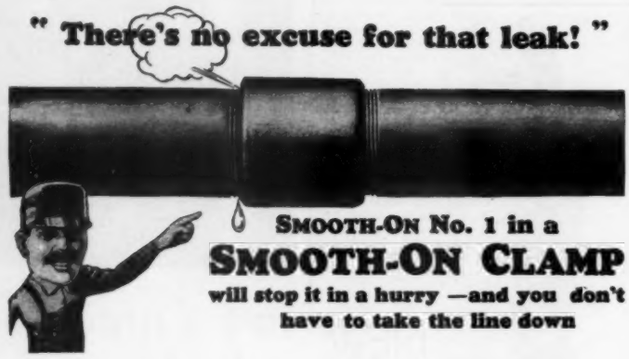
" There's no excuse for that leak! "

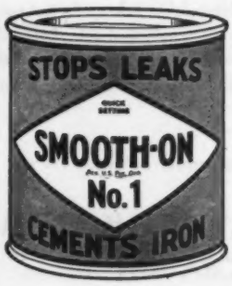


SMOOTH-ON No. 1 in a

SMOOTH-ON CLAMP

will stop it in a hurry —and you don't have to take the line down

THIS combination makes a perfect barrier against thin hot or cold oil and gasoline. Smooth-On sealing of cracks, breaks, porous spots and joints in apparatus or lines containing these hard-to-handle fluids assures absolute and lasting tightness even where the vibration and pressure and temperature changes are severe.

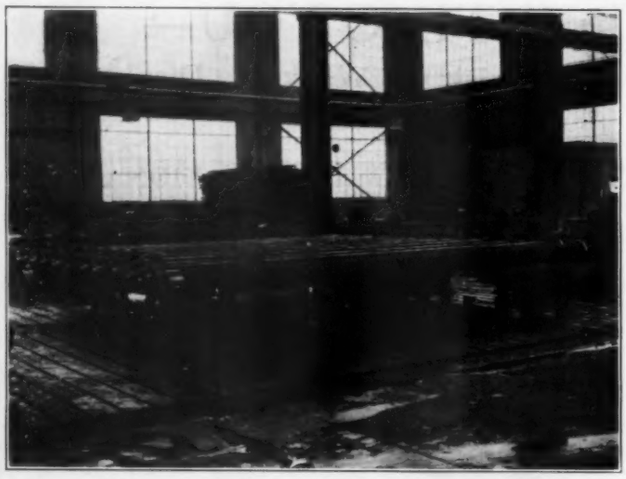


Correct application of Smooth-On No. 1 for hundreds of every day and emergency jobs is explained and illustrated in the Smooth-On Handbook, which should be on your desk for quick reference.

Ask us for the SMOOTH-ON *Handbook and get* SMOOTH-ON *No. 1 in 1 or 5-lb. can or 25 or 100-lb. keg and* SMOOTH-ON *Pipe Clamps in any size from your dealer or if necessary from us.*

SMOOTH-ON MFG. CO., Dept. 66,
570 Communipaw Ave., Jersey City, N. J.

Do it with **SMOOTH-ON**



Showing a series of tube bundles for heat exchangers.

Send us your Inquiries.

J. P. DEVINE MFG. CO., Inc.
Subsidiary of Mt. Vernon Car Mfg. Co.
MOUNT VERNON, ILL.

NOTICE

Our manufacturing plant includes a large stress-relieving oven to handle 11 feet diameter welded vessels up to 100 feet in length; also X-Ray department to fabricate Class 1 equipment.

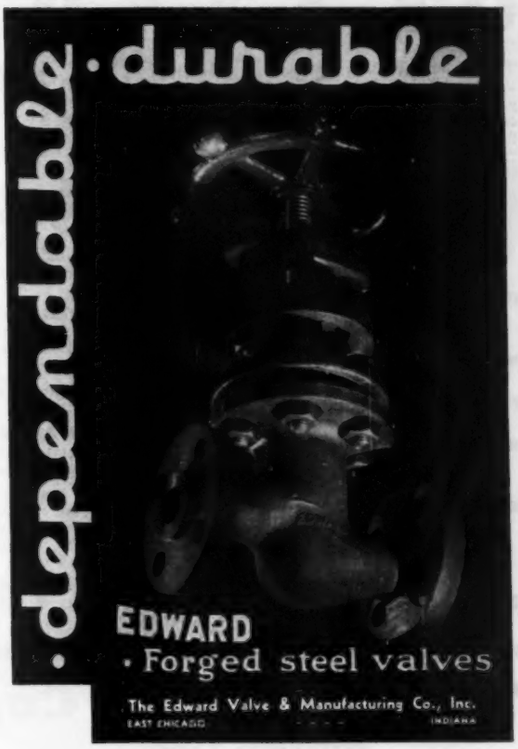
Company and plant address—	Field location—	Type of plant	Daily cap'y (gals.)
Barker & Goforth	Ranger, 5 mi. W	Absp.	*1,500
Bell Oil & Gas Co.	Skellytown	Absp.	5,000
Bell Oil & Gas Co., Bellco, Tex.	Sec. 51, Blk. 24, H.&G.N. Sur., Wheeler County	Absp.	5,000
Big Lake Oil Co., Texon	Sec. 2, Blk. 2, Reagan County	Absp.	50,000
Breckenridge Gasoline Co., Breckenridge	Breckenridge	Absp.	12,000
California United Gasoline Corp., Coleman	Overall ranch	C-A	10,000
California United Gasoline Corp., Coleman	Weaver ranch	C-A	10,000
Canadian River Gas Co., Colorado Springs, Colo.	Sec. 33, Blk. P. Mc., E.L. R.R. Sur., Moore County	Absp.	30,000
Cannon Gasoline Co., Box 963, Amarillo	2½ mi. N Amarillo	Absp.	5,000
Cargray Corp., Amarillo, Tex.	Sec. 46, Blk. 4	Absp.	45,000
Coltexo Corp., Lefors	Sec. 2, A.C.H.&B. Sur., Gray County	Absp.	40,000
Coltexo Corp., Lefors	Sec. 1, H.&G.N., Blk. B-2, Gray County	Absp.	40,000
Coltexo Corp., Lefors	B.&B. Sur. 2, Gray County	Absp.	20,000
Columbian Gasoline Corp., Shamrock	Sec. 46, H.&G.N., Blk. 17, Wheeler County	Absp.	7,000
Consolidated Gasoline Co., Eastland	Eastland, 2 mi. SW	Absp.	12,000
Continental Oil Co., Wichita Falls	C. Winters Sur., Wichita County	Comp.	2,500
Clymore Co., Inc., Corpus Christi	Refugio	Absp.	30,000
Empire Oil & Refining Co., Pampa	NE, Sec. 152, Blk. 3	Absp.	50,000
Excelsior Refining Co., Henderson, Tex.	M. J. Pru Sur., 9 mi. from Henderson	Absp.	20,000
Gladewater Gasoline Co., Gladewater	J. S. Crosby Sur.	Comp.	10,000
Graham Oil & Gas Co., Graham	Morrison farm	Absp.	8,000
Gulf Production Co., Fort Worth	Sec. 1, L.A.L. Sur., Stephens County	Absp.	10,000
Gulf Production Co., Fort Worth	S. B. Hollingsworth and H. B. Dance Sur., Rusk County	Comp.	15,000
Hanlon Gasoline Co., Breckenridge	3 mi. SE Breckenridge	Absp.	50,000
Hanlon-Buchanan Gasoline Co., Gladewater	Near Gladewater	Absp.	25,000
Harmony Gasoline Corp., Ardis Bldg., Shreveport, La.	S. G. Smith farm, Wm. H. Castleberry Sur., Gregg County	Absp.	15,000
Henderson, F. C., Inc., Sanford	Sanford	Absp.	20,000
Huber Petroleum Co., Box 278, Borger	Sec., A.&B. Sur.	Absp.	30,000
Humble Oil & Refining Co., Rising Star	Brown County	Absp.	10,000
Humble Oil & Refining Co., Iraan	Pecos County	Absp.	20,000
Humble Oil & Refining Co., Neches	Anderson County	C-A	7,500
Humble Oil & Refining Co., Overton	Rusk County	Comp.	25,000
Humble Oil & Refining Co., Kilgore	Rusk County	Comp.	17,000
Humble Oil & Refining Co., Bellville	Austin County	Absp.	10,000
Humble Oil & Refining Co., Iraan	Pecos	Absp.	*20,000
La Salle Petroleum Co., Wright Bldg., Tulsa, Okla.	Burkburnett	Comp.	*3,000
Lisbon Gasoline Co., Inc., Shreveport	Rusk County	Comp.	15,000
Lone Star Gas Co., Petrolia	3 mi. S Petrolia	Absp.	15,000
Lone Star Gas Co., Gainesville	2½ mi. W Gainesville	Absp.	*15,000
Lone Star Gas Co., Gordon	2 mi. E Gordon	Absp.	25,000
Lone Star Gas Co., Brazos	2 mi. E Brazos	Absp.	*15,000
Lone Star Gas Co., Desdemona	6 mi. SE Desdemona	Comp.	*2,000
Lone Star Gas Co., Box 488, Ranger	9 mi. S Ranger	Comp.	5,000
Lone Star Gas Co., Box 882, Ranger	7 mi. NE Ranger	Comp.	2,000
Lone Star Gas Co., R.F.D. 1, Cisco	7 mi. SE Moran	Absp.	5,000
Lone Star Gasoline Co., Box 788, Ranger	Ranger (3)	Absp.	65,000
Lone Star Gasoline Co., Box 788, Ranger	Eastland	Absp.	6,500
Lone Star Gasoline Co., Box 788, Ranger	Olden	Absp.	*8,500
Lone Star Gasoline Co., Drawer 00, Breckenridge	Breckenridge	Absp.	31,000
Magnolia Petroleum Co., Burkburnett	J. G. Hardin farm, 1 mi. NW Burkburnett	Comp.	4,250
Magnolia Petroleum Co., Electra	Sec. 17, Blk. 13, H.&T.C. Ry. Co. Sur.	Comp.	4,500
Magnolia Petroleum Co., Olden	R. S. Harris farm, Matt Finch Sur.	Absp.	9,000
Magnolia Petroleum Co., Desdemona	Caruth farm, Smelzer Sur.	Absp.	7,500
Magnolia Petroleum Co., Pampa	NE, Sec. 82, Blk. 3, I.&G. N. Ry. Sur.	Absp.	4,250
Magnolia Petroleum Co., Le Fors	Sec. 30, Blk. B-2, H.&G. N. Ry. Sur.	Absp.	15,000
Magnolia Petroleum Co., Skellytown	Sec. 91, Blk. 4, I.&G.N. Ry. Sur.	Absp.	3,500
Magnolia Petroleum Co., Magic City	NE, Sec. 39, Blk. 24, H. &G.N. Sur.	Absp.	2,000
Magnolia Petroleum Co., Kings Mill	Sec. 153, Blk. 3, I.&G.N. Sur.	Absp.	10,000
Mid-Kansas Oil & Gas Co., Thompson Bldg., Tulsa, Okla.	J. W. Hill lease, Stephens County, Eliasville	Absp.	7,000
Mid-Kansas Oil & Gas Co., Thompson Bldg., Tulsa, Okla.	Tullos lease, Stephens County, Eliasville	Absp.	18,000
Midland Gasoline Co., Box 26, Conroe	Conroe Field, Montgomery County	Absp.	15,000
National Supply Co. of Texas, Shamrock	SE, Sec. 41, Blk. 24, Wheeler County	Absp.	10,000
Ockland Gasoline Production Co., Tulsa, Okla.	Desdemona	Absp.	4,000
Omar Gasoline Co., Wichita Falls	NW of Burkburnett	Comp.	11,500
Orfic Gasoline Production Co. of Texas, 508 McBirney Bldg., Tulsa, Okla.	Desdemona	Comp.	4,000
Pacific American Gasoline Co. of Texas, Box 278, Borger	Sec. 28, Blk. Y, A.&B. Sur.	Absp.	25,000
Paramount Natural Gasoline Co.	Sec. 28, Blk. D-2, H.&G. M. Sur.	Absp.	15,000
Phillips Petroleum Co., Breckenridge	Sec. 8, T.&P. R.R. Sur., Blk. 5, Stephens County	Absp.	*15,000
Phillips Petroleum Co., Borger	NE SE, Sec. 21, Blk. Y, A.&B. Sur.	Absp.	10,000
Phillips Petroleum Co., Bowers	W half, Sec. 62, H.&G.N. Sur., Blk. B-2, Gray County	Absp.	50,000
Phillips Petroleum Co., Canadian	NW SE, Sec. 1, Blk. X02, Hutchinson County	Absp.	20,000
Phillips Petroleum Co., Carson	W. central, Sec. 115, I.&G. N. Sur., Blk. 5, Carson County	Absp.	20,000
Phillips Petroleum Co., Eliasville	6.88 ac. N half, Sur. 1,174 T.E.&L., Stephens County	Absp.	12,000
Phillips Petroleum Co., Frankell	Sec. 51, T.&P. Sur., Blk. 6, Stephens County	Absp.	8,500
Phillips Petroleum Co., Gorman	SE cor. Thos. Mulryne Sur. A377, H.&T.C., Blk. 1, Eastland County	Absp.	8,000
Phillips Petroleum Co., Gray	E half, Sec. 32, H.&G.N. Sur., Blk. 2, Gray County	Absp.	100,000
Phillips Petroleum Co., Helios	W. A. Eaken 132-ac. tract, Eastland County	Absp.	15,000
Phillips Petroleum Co., Herron City	SE, Sec. 20, P. J. Humphrey Sur. A-153	Absp.	9,000
Phillips Petroleum Co., Hohertz	12 ac., Sec. 62, Blk. 4, T.&P.R.R. Sur., Stephens County	Absp.	5,000
Phillips Petroleum Co., Ibex	NW, Sec. 28, B. AL., Shackelford County	Absp.	20,000
Phillips Petroleum Co., Johnson	Cen. 60 ac., S half, Sec. 69, Blk. 46, H.&T.C. Sur., Hutchinson County	Absp.	50,000

Company and plant address—	Field location—	Type of plant	Daily cap'y (gals.)
Phillips Petroleum Co., Judkins	W 60 ac., N half S half Sec. 1, University land, County	Absp.	*15,000
Phillips Petroleum Co., Le Fors	NE NE, Sec. 56, Blk. 25, H.&G.N. Sur., Gray County	Absp.	15,000
Phillips Petroleum Co., McCamey	NE NE, Sec. 216, C.C.S. D.&R.G.N.G.R.R. Sur., Blk. F, Crane County	Absp.	50,000
Phillips Petroleum Co., North	SW, Sec. 35, and NW, Sec. 36, I.&G.N. Sur., Blk. 3, Gray County	Absp.	60,000
Phillips Petroleum Co., Pampa	W half SW, Sec. 88, H.& G.N. Sur., Blk. B-2, Gray County	Absp.	60,000
Phillips Petroleum Co., Panhandle	SW, Sec. 113, I.&G.N.R.R. Sur., Blk. 5, Carson County	Absp.	15,000
Phillips Petroleum Co., Pantex	SE cor. Mary Whitley Sur., Blk. 8, Hutchinson County	Absp.	50,000
Phillips Petroleum Co., Rockcreek	N half NW, Sec. 22, Blk. Y, A.&B. Sur., Hutchinson County	Absp.	60,000
Phillips Petroleum Co., South Bend	20 ac., N. centr. J. Garrett Sur. A-108, Young County	Absp.	9,000
Phillips Petroleum Co., Sanford	Sec. 81, Blk. 46, H.&T.C. R.R. Sur., Hutchinson County	Absp.	20,000
Phillips Petroleum Co., Texroy	SE, Sec. 3, Blk. B-3, D.& S.E.R.R. Sur., Hutchinson County	Absp.	50,000
Philmore Gasoline Corp., 723 Kennedy Bldg., Tulsa, Okla.	E half, J. M. Daugherty 150 ac., Isaac Hughson Sur.	Absp.	20,000
Pure Oil Co., Van	Van Zandt County	Comp.	37,000
Red River Oil Co., Box 712, Tulsa, Okla.	Electra	Comp.	5,000
Roeser & Pendleton, Inc., Fort Worth	NE 85, E.T. Ry. Sur., Shackelford County	Absp.	25,000
Roeser & Pendleton, Inc., Fort Worth†	Reynolds ranch, Shackelford County, 7 mi. NW Albany	Absp.	25,000
Shamrock Oil & Gas Co., Pampa	Sec. 50, Blk. 25, H.&G.N. Sur.	Absp.	15,000
Shell Petroleum Corp., Skellyville	NW 105, Blk. 4, of I.&G.N. Sur.	Absp.	5,000
Shell Petroleum Corp., Pampa	SW, Sec. 83, Blk. 3, I.& G.N. Sur.	Absp.	8,000
Shell Petroleum Corp., Pampa	SE, Sec. 107, Blk. 5, I.& G.N. Sur.	Absp.	12,000
Signal Gasoline Co. of Texas, Box 157, Best	Best, Reagan County	Absp.	50,000
Sinclair Prairie Oil Co., Box 1674, Longview	J. Masely Sur.	Comp.	20,000
Skelly Oil Co., Box 178, Stinnett	NW cor. Matilda Robinson Sur., Moore County	Absp.	9,000
Skelly Oil Co., Box 816, Burkburnett	G. W. Darby or J. G. Hardin Sur.	Comp.	7,000
Skelly Oil Co., Box 127, Skellytown	NE, Sec. 174, Blk. 3	Absp.	18,000
Skelly Oil Co., Box 336, Whittenburg	SW, Sec. 4, Blk. B-4, D.& S.E. Ry. Sur.	Absp.	11,500
Skelly Oil Co., Box 952, Burkburnett	H.T.&B.R.R. Sur., N 110 ac., Wichita County	Comp.	1,500
Skelly Oil Co., Box 127, Skellytown	S half, Sec. 88, Blk. 4, I.&G.N. Sur.	Absp.	20,000
Skelly Oil Co., Box 127, Skellytown	NW cor., Sec. 86, Blk. 4, I.&G.N. Sur.	Char.	6,000
Smith Brothers Refining Co., McLean	McLean	Absp.	40,000
Southern Gasoline Co., Ranger	Tiffin	Absp.	2,500
South Plains P. L. Co., Lubbock	Sec. 45, Blk. 2, A.B.&M. Sur.	Absp.	35,000
Stanolind Oil & Gas Co., Desdemona	Desdemona No. 5	Comp.	10,000
Stanolind Oil & Gas Co., Desdemona	Desdemona No. 6	Absp.	10,000
Sunray Oil Co., Tulsa, Okla.	Sunray, Moore County	Absp.	8,000
Texas Company, The (Delaware), Electra	½ mi. NW Electra	Comp.	9,300
Texas Company, The (Delaware), Burkburnett	3 mi. NW Burkburnett	Comp.	33,000
Texas Company, The (Delaware), Olney	2½ mi. NE Olney	Comp.	7,000
Texas Co., Foard City	15 mi. NW Foard City	Comp.	10,000
Texas Gasoline Co., Desdemona	1½ mi. from Desdemona	Absp.	2,000
Texas Pacific Coal & Oil Co., Fort Worth	Caddo	Absp.	10,000
Texas Pacific Coal & Oil Co., Fort Worth	Strawn	Absp.	5,000
Texas Pacific Coal & Oil Co., Fort Worth	Eliasville	Absp.	10,000
Texas Pacific Coal & Oil Co., Fort Worth	Caddo	Absp.	10,000
Texoma Natural Gas Co., 20 N. Wacker Drive, Chicago, Ill.	Fritch, Sec. 5, T.T.R.R. Sur., Blk. Y-2	Absp.	60,000
United Gas Public Service Co., Box 2492, Houston	Jane Thorpe Sur., Panola City	Absp.	8,000
United Gas Public Service Co., Box 2492, Houston	Refugio Field	Absp.	25,000
Waggoner Gasoline Co., Electra	Sec. 33, Blk. 4, Wilbarger County	Absp.	20,000
Ward Gasoline Co., Sayre, Okla.	7 mi. N Breckenridge	Absp.	5,000
Western Oil Corp. of Texas, Philcade Bldg., Tulsa	Electra	Comp.	2,000
Wilcox, H. F., Oil & Gas Co., Tulsa, Okla.	Sec. 61, Blk. 3, I.&G.N. Sur.	Absp.	8,000

†Owned jointly with Continental Oil Co.

WEST VIRGINIA

American Oil Development Co., Pittsburgh, Pa.	Tyler County	Comp.	6,000
American Oil Development Co., Pittsburgh, Pa.	Pleasants County	Comp.	100
American Oil Development Co., Pittsburgh, Pa.	Tyler County	Comp.	100
Carbide & Carbon Chemicals Corp., 30 E. 42nd St., New York, N. Y.	Hastings	Comp.	1,000
Carbide & Carbon Chemicals Corp., 30 E. 42nd St., New York, N. Y.	Diamond	Comp.	2,500
Carnegie Natural Gas Co., Hundred	Hundred	Absp.	3,300
Carnegie Natural Gas Co., Pine Grove	Pine Grove	Absp.	3,000
Carnegie Natural Gas Co., Underwood	Underwood	Absp.	3,000
Carnegie Natural Gas Co., Woodruff	Woodruff	Absp.	1,800
Carnegie Natural Gas Co., Toll Gate	Ritchie County	Absp.	....
Casto Oil Co., 318½ Juliana St., Parkersburg	Pleasants, Tyler and Ritchie Counties	Comp.	250
Chemical Oil & Gas Co., Big Bend	Grantsville	C-A	500
Cumberland & Allegheny Gas Co.	Jane Lew, 3 mi. S	Absp.	3,000
Dinsmoor & Co., St. Marys	Pleasants County	Comp.	325
Dun Mar Oil & Gas Co., Route 3, Fairview	Jarke Run	Comp.	50
Falling Rock Cannel Coal Co.	Weir	Absp.	3,000
Federal Oil & Gas Co., Elizabeth	Elizabeth, S	Comp.	250
Federal Oil & Gas Co., Weston	Weston, 3 mi.	Comp.	500
Hapgood, R. T., & Co., Charleston	Cedar Grove	Char.	3,500
Henighan & Hanlon, Sistersville	Doddridge County	Comp.	200
Hope Construction & Refining Co.	Barren Creek	Absp.	*12,000
Hope Construction & Refining Co.	Bristol	Absp.	8,000
Hope Construction & Refining Co.	Littleton	Absp.	*15,000
Hope Construction & Refining Co.	Middlebourne	Comp.	400
Hope Construction & Refining Co.	Mount Clair	Absp.	2,500
Hope Construction & Refining Co.	Pine Grove	Absp.	40,000
Hope Construction & Refining Co.	Rachel	Absp.	*10,000
Hope Construction & Refining Co.	Salem	Absp.	4,000
Hope Construction & Refining Co.	Spencer	Absp.	*1,000
Hope Construction & Refining Co.	Waverly	Absp.	5,000
Jennings Oil Co., 608 Columbia Bldg., Pittsburgh	Wetzel County	Comp.	100
Kanawha Oil Co., 608 Columbia Bldg., Pittsburgh	Wetzel County	C-A	1,000
Kanawha Oil Co., 608 Columbia Bldg., Pittsburgh	Wetzel County	Comp.	100
Manufacturers Light & Heat Co., Rosbys Rock	Clay Township	Absp.	1,740



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Viking Rotary Pumps

Which will be on exhibit in
Booth No. 8 Refiners & Marketers Bldg.

International Petroleum
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Tulsa -- May 12 to 19 inclusive

Viking Rotary Pumps -- *First in America*

VIKING PUMP COMPANY
Cedar Falls, Iowa

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Throughout the Oil Fields of the world the many technical products produced from the engineering experience of The Sullivan Co. are Okayed as "Life Preservers" for the Oil Fields. They include:

SLUSH-MIX. Mud heavier. Greases bit, fills caves and weak spots in wall. Controls gas. Repels friction and corrosion.

GELITE. The guaranteed, low cost mud gel. Rotary mud compound.

MUD-FLUX. Mud thinner. Cuts down viscosity.

FISSURSEAL. For lost circulation. Caving shale, etc.

KLEEN-A-WELL. Cleans tubing and rods. Increases production.

KONSET. Buy-word of veteran oil men—liquid cement accelerator, hardener and waterproofing, okeyed by 3 Governments.

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SOLRITE. For boiler feed water. Makes hard water soft. Prevents corrosion, scaling, pitting or foaming.

BLACK JOE. A superior paint for all equipment. Boilers, smokestacks, etc.

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The SULLIVAN Co.

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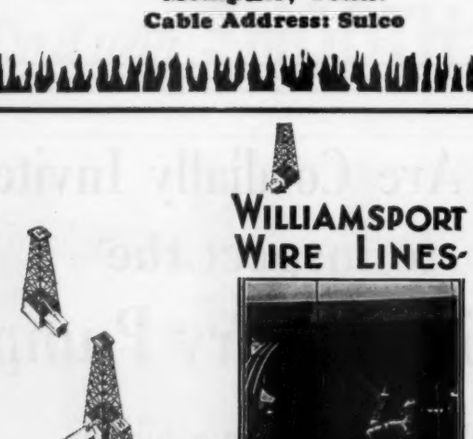

WILLIAMSPORT WIRE LINES

The Quality Lines for Good Drillers

Ask any driller who uses Williamsport lines, why he prefers them. He will tell you they give uniformly superior service—and there is no guess work in determining the grade of steel used in their manufacture.

WILLIAMSPORT WIRE ROPE CO.

Main Office and Works: Williamsport, Pa.

Branch Sales Offices: 122 S. Michigan Ave., Chicago, Ill.
Oil Country Sales Offices: Williamsport Bldg., Fourth and Midland Valley Tracks, Tulsa, Okla.; 1516 Chestnut Street, Houston, Texas.

Company and plant address—	Field location—	Type of plant	Daily capy (bbls.)
Manufacturers Light & Heat Co., Porters Falls	Green Township	Absp.	6,500
National Compressing Co., Parkersburg	Rutherford, Ritchie County	Comp.	50
New York Petroleum Co., Box 563, Parkersburg	Ritchie County	Comp.	150
New York Petroleum Co., Box 563, Parkersburg	Tyler County	Comp.	150
Oil & Gas Co., 318½ Juliana St., Parkersburg.	Ritchie County	Comp.	250
Owens, Libbey-Owens Gas Dept., Charleston ...	South Malden, Kanawha County	Absp.	10,000
Pure Oil Co., Dawes	Kanawha County	Comp.	11,000
Ramage, S. Y., Oil City	Pleasants County	Comp.	50
Reno Oil Co., Sistersville	Tyler County	Comp.	50
Reno Oil Co.	Ritchie County	Comp.	75
Reno Oil Co.	Tyler County	Comp.	44
Reno Oil Co.	Ritchie County	Comp.	50
Reno Oil Co.	Ritchie County	Comp.	75
Reserve Gas Co., Box 1755, Pittsburgh, Pa. ...	Valley Chapel	Absp.	20,000
Southern Oil Co., 1005 Farmers Bank Bldg., Pittsburgh, Pa.	Sistersville, Tyler County	Comp.	750
Southern Oil Co., 1005 Farmers Bank Bldg., Pittsburgh, Pa.	Porters Falls, Wetzel County	Comp.	*100
Southern Oil Co., 1005 Farmers Bank Bldg., Pittsburgh, Pa.	Macfarlan, Ritchie County	Absp.	1,500
South Penn Oil Co., Pittsburgh, Pa.	Alvy	Comp.	1,500
South Penn Oil Co., Pittsburgh, Pa.	Bulls Mills	Comp.	500
South Penn Oil Co., Pittsburgh, Pa.	Blue Creek	Comp.	1,700
South Penn Oil Co., Pittsburgh, Pa.	Blue Creek	Comp.	3,000
South Penn Oil Co., Pittsburgh, Pa.	Bula (near Wana)	Comp.	400
South Penn Oil Co., Pittsburgh, Pa.	Clay	Comp.	2,200
South Penn Oil Co., Pittsburgh, Pa.	Coco	Comp.	2,200
South Penn Oil Co., Pittsburgh, Pa.	Fink	Comp.	1,000
South Penn Oil Co., Pittsburgh, Pa.	Glenville	Comp.	1,100
South Penn Oil Co., Pittsburgh, Pa.	McFarlin	Comp.	2,000
South Penn Oil Co., Pittsburgh, Pa.	Mannington	Comp.	1,500
South Penn Oil Co., Pittsburgh, Pa.	Metz	Comp.	1,500
South Penn Oil Co., Pittsburgh, Pa.	Pine Grove	Comp.	2,500
South Penn Oil Co., Pittsburgh, Pa.	Shirley	Comp.	500
South Penn Oil Co., Pittsburgh, Pa.	Shirley	Comp.	1,200
South Penn Oil Co., Pittsburgh, Pa.	Smithfield	Comp.	3,000
South Penn Oil Co., Pittsburgh, Pa.	Spencer	Comp.	2,000
South Penn Oil Co., Pittsburgh, Pa.	Statler Run	Comp.	2,200
South Penn Oil Co., Pittsburgh, Pa.	Walton	Comp.	2,400
South Penn Oil Co., Pittsburgh, Pa.	Wolf Summit	Comp.	3,000
South Penn Oil Co., Pittsburgh, Pa.	Yawkey	Comp.	3,000
South Bros., Inc., Steubenville, Ohio	Hancock County	Comp.	*200
Tyler Oil Co., Sistersville	Tyler County	Comp.	49
Tyler Oil Co., Sistersville	Tyler County	Comp.	35
Tyler Oil Co., Sistersville	Tyler County	Comp.	2:
Viking Gasoline Corp., Charleston	Morgantown	Char.	1,000
Viking Realty Co., Martha	Cabell County	Char.	1,000
Virginian Gasoline & Oil Co., Sandyville	Jackson County	Char.	40,000
Virginian Gasoline & Oil Co., Ona	Cabell County	Absp.	*12,000
Virginian Gasoline & Oil Co., Charleston	Kanawha County	Char.	25,000
Virginian Gasoline & Oil Co., Clendenin	Kanawha County	Absp.	40,000
Virginian Gasoline & Oil Co., Charleston	Kanawha County	Char.	2,000
Virginian Gasoline & Oil Co., Spencer	Roane County	Char.	12,000
Virginian Gasoline & Oil Co., St. Albans	Kanawha County	Char.	2,500
Virginian Gasoline & Oil Co., Louisia, Ky.	Wayne County	Char.	*3,500
Virginian Gasoline & Oil Co., Hubball	Lincoln County	Char.	12,000
Virginian Gasoline & Oil Co., Mammonth	Kanawha County	Absp.	2,500
Virginian Gasoline & Oil Co., Blue Creek	Kanawha County	Comp.	1,200
Virginian Gasoline & Oil Co., Stoffel	Kanawha County	Absp.	1,200
Virginian Gasoline & Oil Co., Elkview	Kanawha County	Absp.	1,000
Virginian Gasoline & Oil Co., Three Mile	Kanawha County	Absp.	3,500
Virginian Gasoline & Oil Co., Pad	Roane County	Absp.	800
Watson, G. L., Parkersburg	Belmont	Comp.	50
Wahl, A. R., Evans City	Foward Twp., Butler County	Comp.	150
Wiser Oil Co., Sistersville	Roane County	Comp.	100
WYOMING			
Continental Oil Co., Denver, Colo.	Sec. 5, R. 78w, T. 39n	Absp.	15,000
New York Oil Co., P.O. Box 1091, Casper	T. 32, R. 95, S. 10	Absp.	1,500
Ohio Oil Co., Manville	Niobrara County	Absp.	7,500
Ohio Oil Co., Rock River	Carbon County	Absp.	4,500
Ohio Oil Co., Columbus	Natrona County	Absp.	14,400
Ohio Oil Co., Kirby	Hot Springs	Comp.	7,540
Producers & Refiners Corp., Casper	NW, Sec. 7-26-89	Absp.	15,000
Standard Engineering Corp., Box 1739, Casper.	Casper	Absp.	2,500
Stanolind Oil & Gas Co., Tulsa	Midwest	Comp.	130,000
Stanolind Oil & Gas Co., Tulsa	Elk Basin	Comp.	*2,000

Uneconomic Operating Units Being Eliminated

(Continued from Page 141)

plants suitable for the East Texas Field is quite different in design from those new plants mentioned as "dry" gas plants for the Panhandle.

The East Texas plants process a relatively small volume of gas. East Texas is now producing close to 60,000 gallons per day and plants are under construction which will add about 20,000 gallons to this within two months' time.

California

California retains its position as first in plant capacity among the 16 states in which plants are located. California showed a reduction in the combined capacity of its plants for the year but still holds a wide margin over Texas which ranks second. In the list of states appearing above, Montana is included for the first time. Another state which might have been included is Michigan. A 5,000-gallon plant is nearing completion there.

Personnel and Survey

In the pages which follow, appears The Oil and Gas Journal's 1934 summary of executive and principal operating personnel of natural gasoline manufacturing companies in the United States, and also a complete list of plants showing the location, type and capacity of each. These data were obtained directly from the respective companies almost without exception.

Summer Field Course of School of Petroleum

The School of Petroleum of the University of Oklahoma, Norman, Okla., offers an eight weeks course for the purpose of studying field problems in the petroleum industry. This year the field work will start June 5 and continue to August 2. The group will study geology, development and operating methods in all the principal oil and gas fields of the Mid-Continent and Gulf Coast areas.

This course is open to students of sophomore standing in any accredited engineering school or college or its equivalent. The fee is $50 to cover salary and expenses of the instructors. All students bear their transportation and other expenses in visiting the oil fields and the average cost, including tuition, for 1933 course was $165 per person. Registration will close June 1 and the total number of students will be limited to 60, divided into groups of 20 each. For further details address Prof. W. H. Carson, acting director, School of Petroleum Engineering, University of Oklahoma, Norman, Okla.

EAST TEXAS PLANT

William Stowell, formerly general manager of the gasoline department of the Humble Oil & Refining Co. is building a well pressure absorption gasoline plant in the south end of the East Texas Field, Rusk County.

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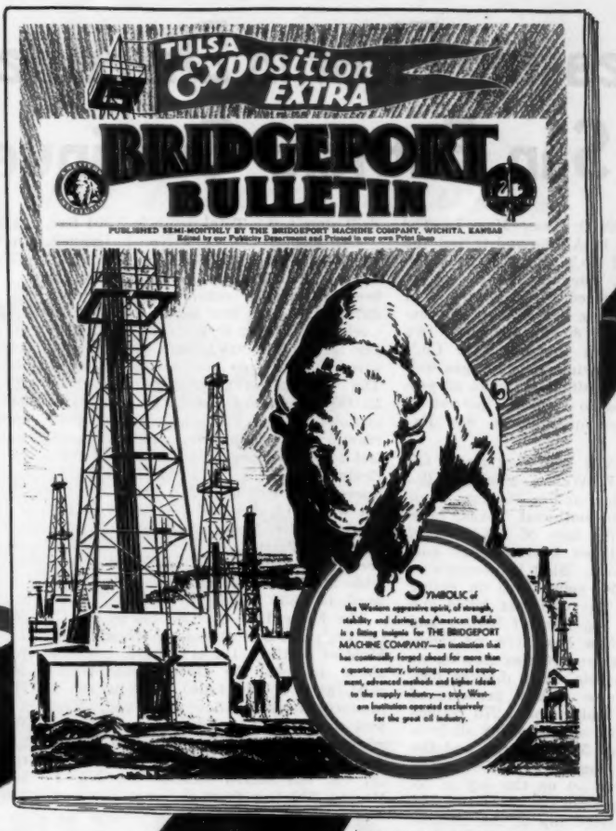
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Increasing Flow in Discovery Southwest of Odem; San Patricio Continues to Hold Interest

SAN ANTONIO, Tex., May 7.—The increasing flow in Atkins and O'Neil and Continental Oil Co.'s No. 1 J. F. Welder, new sand discovery southwest of Odem, which proved the existence of a new producing area and has caused considerable activity during the past two weeks, along with Plymouth Oil Co.'s No. 1 Welder showing for a big gas well with still some possibilities for an oil producer, continued to hold the interest of Southwest Texas operators in San Patricio County.

Atkins & O'Neil and Continental Oil Co.'s No. 1 J. F. Welder, about 5 miles southwest of Odem and in the Trans-Salt Dome region of Southwest Texas, came in flowing at the rate of 7½ bbls. of 33.9 gravity oil per hour through one-quarter inch choke. Shut in pressure on tubing was 1,550 pounds and on casing 1,700 pounds. The well was killed and tubing was set 3½ feet off bottom and since then the flow has increased steadily and at latest report was flowing at the rate of 175 bbls. daily through one-quarter inch choke with a pressure of 500 pounds on tubing and 1,275 pounds on casing. It had sand showing oil from 5,374-75 feet, cap 5,375-76 feet, and the main pay sand from 5,376-82 feet. The 7-inch casing was set on the cap at 5,-375 feet. It topped the Discorbis at 4,066 feet and encountered top of the Heterostegina at 4,221 feet actual or 4,161 feet subsea.

Most of the leasing was transacted before the well was actually brought in. After the first drill stem test companies started taking all available acreage. Several new locations have already been staked in the area and within the near future will in all probability be the center of an extensive drilling campaign.

About 3 miles north of Sinton and 7 miles northeast of the new discovery, Plymouth Oil Co.'s No. 1 Welder built up 800 pounds pressure and showed 150 feet of fresh water with mud and oil on a drill stem test from 5,415-18 feet. Five gallons of 45 gravity oil was recovered in the test. A string of casing has been set and will probably be the first of the week before plugs are drilled. A Schlumberger test was run which gave promise of at least a big gas well and some still have hopes it will make an oil producer.

Bunte and others' No. 1 C. C. Smith, about 3 miles southwest of Odem and in the A. Armstrong Survey, has spudded. This is a very important test and will be watched with much interest.

Also holding considerable interest during the past week was Camp and others' No. 2 King, north of the old Agua Dulce Field and in Section 24 of the R. Garza Survey, which was preparing to make a drill stem test after encountering 4 feet of good looking oil sand. It topped sand at 5,531 feet and had 8 feet of sand with hole bottomed at 5,539 feet. The top 4 feet is said to be hard sand carrying gas and the bottom 4 feet soft oil sand.

North of Beeville in Bee County, Howeth & Swiger's No. 1 Scott in the Molina Survey was drilling below 5,100 feet. The test topped Dibollensis at 4,572 feet, had top of Pettus sand 4,769 feet with sand showing oil and gas from 4,769-78 feet, and showed salt water at 4,970 feet. Phillips Petroleum Co.'s No. 1 Morgan, on a block of 13,930 acres in the Eyles Survey, was drilling below 5,729 feet. It topped the Vicksburg at 4,299 feet and had top of Jackson 4,449 feet actual or 4,285 feet subsea.

Caeser Oil Co.'s No. 1 Pulling, a rank wildcat test about 6 miles northwest of Pettus and in the F. Lewis Survey, topped a sand at 3,007 feet and was preparing to set casing without making a drill stem test. Total depth is 3,304 feet.

Continental Oil Co.'s No. 1 Driscoll, the new deep sand discovery in the old Driscoll Pool in Duval County which has been attracting considerable attention during the past two weeks, late in the week was flowing little more than 2 bbls. per hour with 300 pounds tubing pressure and 825 pounds casing pressure. The well is estimated good for about 12,000,000 feet of gas. The well came in flowing about 1½ bbls. per hour of 33 gravity oil from a total depth of 3,448 feet after plugging back from 3,461 feet. Bridwell Oil Co.'s No. 1 Wood Welder in Survey No. 102 has been abandoned as dry with total depth of 2,364 feet. In the north Kohler Field, Windsor Oil Co.'s No. 1 B. Peters in Survey No. 34, has been completed for 30,000,000 feet of gas with 900 pounds rock pressure. Total depth is 2,630 feet.

The Eagle Hill Oil Co. and S. R. C. Oil Co.'s No. 2 Foster, in the Eagle Hill Field of northern Duval County, is going ahead to test the Government Wells sand, after it had failed to show for a producer in the shallow Cole sand. The well showed 300 pounds pressure in two minutes in the Cole sand at 1,463 feet. About 5 miles south of San Diego, Sun Oil Co. has staked location for No. 1 Moreno 330 feet from the east line and 2,000 feet from the south line of the northwest corner of H&W Survey No. 537, in Section 540.

Government Wells Field

The Government Wells Field marked up 10 completions during the past week, seven of which were producers and three dry holes. Central Producers' No. 10 Tuck & Johnson was completed for 27 bbls. per hour at 2,318 feet. Cox & Hamon's No. 10-A Lundell State bottomed hole at 2,229 feet and made 50 bbls. per hour. No. 10 Lundell-State was junked and abandoned at 1,535 feet. Magnolia Petroleum Co.'s No. 4 J. W. Riley was drilled to a total depth of 2,363 feet and made 30 bbls. per hour. Magnolia's No. 1 L. B. Moody was abandoned after a drill stem test showed salt water at 2,346 feet. Reed & McKay's No. 3 Lundell-State drilled to a total depth of 2,253 feet and made 25 bbls. per hour. Reed-McKay's No. 5 Lundell-State was completed for 20 bbls. per hour at 2,240 feet. Southwest Drilling Co.'s No. 1 Hahl bottomed hole at 2,514 feet and was abandoned as dry. Sun Oil Co.'s No. 56 Weiderkehr made 52 bbls. per hour at 2,302 feet. The Texas Co.'s No. 8 Duval ranch was completed for 30 bbls. per hour after drilling to a total depth of 2,294 feet.

Wildcat Operations in Southwest Texas

Week Ending May 5

ARANSAS COUNTY

Company, well, farm name, section and block—	Remarks:
American Liberty Oil Co.'s No. 1 Dietzel, 1,650 ft. from N line and 6,800 ft. from E line of John Smith Sur. in Lot 32, Blk. 4 (2 mi. NW of Rockport)	(No report) 4,880 ft.

ATASCOSA COUNTY

Texas Pet. Co.'s No. 2 Masterson, 290 ft. from E line and 280 ft. S of No. 1 (7½ mi. S of Sumerset), J. M. Mott Sur. No. 386, Subd. No. 3, B.&G.W. Carruthers estate	10-in. csg. at 20 ft.; drlg. 900 ft.

BANDERA COUNTY

Parkford et al's No. 1 Mrs. R. L. Duke, G.H.&S.A. Sur., Sec. 7	Material.
Peerless O. & G. Co.'s No. 1 Garrison Sur. No. 506, 1,500 ft. from N and 2,700 ft. from E lines of Sur. (8 mi. SW of Medina)	Location.

BASTROP COUNTY

Chas. E. Anderson's (Ca-Tex O. & G. Dev. Co.) No. 1 Pendergrass, 1,343 ft. from NE line, 310 ft. from SE line of 130-ac. tract in Henry Warnell Sur.	S.D. 1,815 ft.
Hinton et al's No. 1 Glass, 2,000 ft. from NW and 1,300 ft. from SW lines of Ferguson estate 239-ac. tract in Henry Warnell Sur.	Top Edwards 1,907 ft.; T.D. 1,909 ft.; showing sulphur water.
Marts & Beavens' No. 1 King, 850 ft. from SW line of farm and survey and 1,000 ft. from NW line of 150-ac. King tract, in Enoch Harris Sur. (3 mi. E of Elgin)	Location.
Ogden & Reed's No. 6 W. P. Talley, 762 ft. from SE line and 200 ft. from SW line of tract in Joshua Gray Sur.	T.D. 2,401 ft.; D.S. test showed 1 thribble mud and show gas; abnd.
Ogden and Sun Oil Co.'s No. 1 J. W. Snowden, 300 ft. from NE line and 255 ft. from SE line of 119-ac. tract in Jasper Standifer Sur.	Drlg. shale 1,770 ft.
Three Oil Co.'s No. 1 M. Ingram, H. S. Morgan Sur.	T.D. 120 ft.; S.D.

BEE COUNTY

Caeser Oil Co.'s No. 1 Pulling, F. Lewis Sur., 150 ft. from NW line, 150 ft. from SW line of 25-ac. tract.	Drlg. shale 2,086 ft.
Ed Folney et al's No. 1 J. B. Borroum, 330 ft. from E line and half way between N and S lines of 8-ac. tract in Geo. Brown Sur. (4½ mi. NW of Mineral).	T.D. 3,207 ft.; fishing.
Heep Oil Co.'s No. 1 J. C. Wood, 466 ft. from N and E lines of F. Crane Sur.	Drlg. sandy shale 3,210 ft.
Howeth & Swiger's No. 1 Scott, 1,043 ft. from S line of Blk. 30 of Howeth & Swiger Subd., Molina Sur.	T.D. 5,105 ft.; abnd.
Elbert Jeanes' No. 1 G. L. Courtney, 1,600 ft. from E line, 330 ft. from S line of tract, G. A. Kerr Sur., 1½ miles NE of Pettus	Rigging up.
McLain et al's No. 2 Laura Weiss, B.&B. Sur., 660 ft. E of No. 1	T.D. 100 ft.; S.D.
Phillips Pet. Co.'s No. 1 Morgan, 4,950 ft. from W, 3,370 ft. from N lines of 13,930-ac. tract, Eyles Sur.	Drlg. 5,340 ft.

BELL COUNTY

Gus Winston et al's No. 3 Warrick, 100 ft. N of James Scroggins' No. 1 Warrick, in Elijah Ingram Sur.	Drlg. black shale 3,198 ft.

BEXAR COUNTY

Joe Beckley's No. 1 fee, 3,100 ft. W and 150 ft. S at right angles from most northerly cor. of Morales Sur. (2 mi. SW of San Antonio)	Drlg. 265 ft.
A. M. Blume's No. 1 H. A. Ridder, E offset to Blume's No. 2 Ridder, J. M. Barrera Sur.	Derrick blew down.
A. M. Blume's No. 2 Louis Ridder, approximately 2,350 ft. N of R.R., 700 ft. E of W line of J. M. Baerera Sur. No. 58	Drlg. lime 1,542 ft.
Kelffer et al's No. 1 Ruiz, SE cor. of 82-ac. tract in F. Rowland Sur. No. 48	Drlg. 1,710 ft.
Dingman & Russell's No. 1 R. J. Coffey, 1,225 ft. from SE line, 1,026 ft. from SW line of 430-acre tract in Rodriguez Sur.	T.D. 1,326 ft.; trying to comp.

(Continued on Page 173)

Amerada Petroleum Co. is ready to spud in on its No. 2 Halff & Oppenheimer, a wildcat test 4 miles southwest of Pearsall in Frio County. This is to be an Edwards lime test and the third to be drilled by the company on its block of 85,000 acres in Frio and Zavala Counties.

About 3 miles east of Elgin in Bastrop County, Marts & Beavens have staked location for No. 1 King, 850 feet from the southwest line of farm and survey and 1,000 feet from northwest line of 150-acre King tract in the Enoch Harris Survey. In the North Dale Pool, Watt L. Sanders' No. 1 Harris, in the John Maximillan Survey No. 22, topped the Austin chalk at 2,149 feet and at latest report was drilling chalk at 2,304 feet.

Union Sulphur Co.'s No. 1 American Rio Grande Land & Irrigation Co., about 7½ miles north of Mercedes in Hidalgo County, was drilling at 4,185 feet. Davis & Harrison's No. 1 Lula George in Tract No. 13, Porcion 41 of the Ancient Jurisdiction of Reynosa, has spudded. Otto Woods has also spudded No. 1 John Lawrence, located in Tract 274, Porcion 39 of the Ancient Jurisdiction of Reynosa.

In southern Karnes County, Magnolia Petroleum Co.'s No. 2 Guy Porter, in the Brooks and Burleson Survey, was also reported preparing to set casing without making a drill stem test after coring the Pettus sand showing oil from 3,638-48 feet. George Ray's No. 1 Radford, in the Nichols Survey, and about 4 miles northeast of the North Pettus field, was drilling below 3,110 feet. It had top of the Jackson 2,370 feet.

In northwestern Starr County, Sun Oil Co.'s No. 6-B M. Guerra & Son, which opened a new producing horizon in the Las Cuevitas area last week in sand from 2,047-55 feet, is now estimated good for 100 bbls. daily. On a drill stem test it showed 280 feet of oil, but had no pressure. The well was then swabbed and a pressure of 480 pounds was built up and it started flowing naturally. It is located about a mile east of the wells producing from the 2,200-foot horizon. Sun immediately made location for No. 7-B M. Guerra & Son and is about 1,600 feet southwest of No. 6-B.

Humble Oil & Refining Co.'s No. 1 R. L. Anderson, about 3 miles northeast of Uvalde and in Uvalde County, was unable to get through the Edwards lime at less than 100 feet with the rotary, having lost returns and is moving in a spudder to carry the well down to about 1,000 feet and setting surface casing. Evans & Johnson's No. 1 Farris, in the J. Hammons Survey, was drilling below 1,100 feet.

Webb County marked up three dry holes during the past week. French Oil Corp's No. 1 Benavides, about 10 miles northwest of Bruni and in Survey No. 706, was abandoned with total depth of 3,201 feet. Lockhart's No. 1 E. Eikel in Survey No. 1672 bottomed hole at 2,032 feet and tested fresh water in sand from 2,026-32 feet, where it has been abandoned. Don E. Megahan and others' No. 1 F. C. Gowdy in Survey No. 2112 was abandoned as dry with total depth of 4,507 feet.

In eastern Cameron County, the Union Sulphur Co. is reported to have leased approximately 25,000 acres from the Port Isabel company. It is reported the contract calls for five wells to approximate total depths of 5,000 feet each. The A. Bert McCollum Co. has recently been making seismographic tests in the eastern part of the county, including some of this land.

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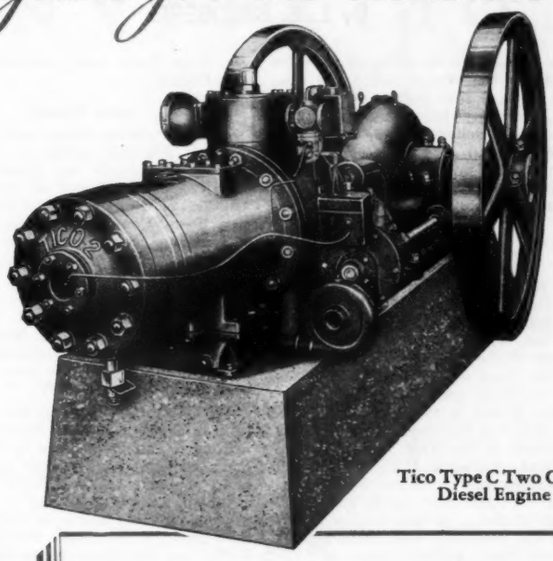

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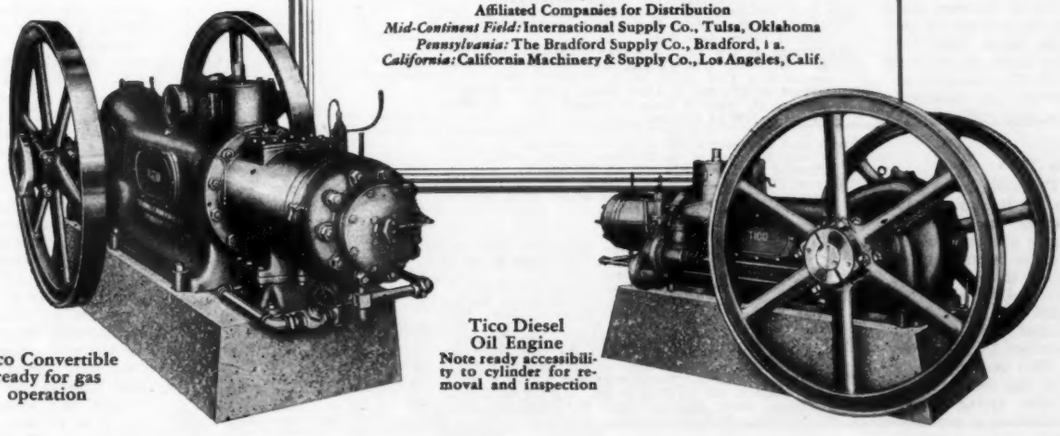

Tico Convertible ready for gas operation

Tico Diesel Oil Engine
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Salt Water Shows in Freestone County Wildcat; 246 Permits Issued in the East Texas Field

By L. E. BREDBERG

DALLAS, Tex., May 7.—Salt water intruded in another likely looking wildcat in East Texas this week. This salt water showing was the second in two weeks. It sprayed out in Daniels Oil & Royalty Co.'s No. 1 P. D. C. Ball, in the J. Y. Augilera Survey, due south of Turlington in eastern Freestone County. Two-inch tubing was swung 10 feet off bottom, which is 4,877 feet. A swabbing test was made with the swab pulled four times, the last time bringing up 4,500 feet of fluid and at 500 feet from the top the swab was blown out of the hole making an estimated 5,000,000 feet of gas. It almost immediately started spraying salt water blowing all night, showing no material change by morning, except with a decrease in the gas volume from the estimated 5,000,000 feet to an estimated 4,000,000 feet. The gas was ignited and the test will be allowed to blow to note any decrease or increase in salt water and gas volume. There was no odor or showing of oil, the gas proving dry.

The test was allowed to produce intermittently through tubing, then through casing, and on one-quarter inch tubing choke the working pressure tested 1,525 pounds whereas the closed-in casing pressure was 1,750 pounds. It will probably be plugged back to shut off water to salvage as a gasser. This test is appearing similar to the Long Lake discovery well about 12 miles southeast in southwest Anderson County. That area has five wells showing prnicipally as a gas-producing area at present and discouraging the drilling of more tests for the present.

Byrd and Frost and others' No. 1 Scott, in the Joseph Crawford Survey, northwest of Slocum in south central Anderson County, which appeared as having good chances of opening another pool, but which made salt water when tested last week, has had tubing and liner pulled and is to be plugged back to the casing point. A number of successive tests will be made from that point down to pick up sufficient oil sand to try to make a well. The majority are skeptical of its chances for making a producer although a gas well may be salvaged out of it.

Cayuga Tests

Tide Water Oil Co. and Texas Seaboard Oil Co.'s No. 1 Rampy, in the James Wilson Survey, approximately three-quarters of a mile southeast of the Cayuga discovery well in northwest Anderson County, the first test in the area to show salt water, from 4,088-4,112 feet, is now running 5-inch pipe to kill the gas. It will be plugged back to 4,065 feet and will be redrilled to 4,068 feet to test the oil sand. This test marks the southeastern limits of the field and establishes the water table, giving the appearance of a thin oil-bearing sand section and cutting down the possibilities of a large ultimate per acre recovery.

The pool may be extended to cover considerable acreage and make up in breadth what it may lack in oil-bearing sand. This week Hill and Hill's No. 1 Tubbs, in the Sam Edmondson Survey, approximately 1 mile east of the nearest producer, which was also a mile northeastern extensioner, is now sure to widen the field to the east although the sand is said to be not as porous or well saturated, and may not make as good a well as the producer to the west. The sand was topped at 4,065 feet and casing is to be cemented at 4,068 feet. Total depth is 4,085 feet. Elevation is 319 feet. Turman Brothers of Tulsa have purchased a half interest in the Hill properties.

River Bed Leased

The Trinity State Oil Co., headed by Earle Brown of Fort Worth, has acquired lease on 121 acres of the Trinity River bed which river flows about 1 mile west of the discovery in the Cayuga area. The lease was acquired by bid to the State Lease and Land Department of Texas. A test is to be spudded within 120 days and the operators will await the outcome of the Tide Water Oil Co. and Texas Seaboard Oil Co.'s No. 2 Edens in the Samuel Snider Survey, approximately 2,000 feet north and 2,000 feet east of the river bed, to the northwest of the discovery well. This will be the first test drilled west of the discovery.

Wildcats

The Trinity Farm Co. has made location for another wildcat in Freestone County, on the N. R. Stewart farm in the R. M. Williams Survey. Five other wildcat or semiwildcat locations were staked this week, three of them northeast of the Van Pool, Van Zandt County. Morris County is also getting a wildcat test.

The Nacogdoches County test of Elm Oil Co. on the J. L. Ayers farm in the J. Weeks Survey, was abandoned this week at a total depth of 4,177 feet. The Tide Water Oil Co. and East Texas Seaboard Oil Co. abandoned a location in the Long Lake area, southwest Anderson County.

Leon County

Shell Petroleum Corp. and others are running 9⅝-inch casing at 6,040 feet, present total depth, and intend making a Trinity sand test out of their No. 1 G. W. Lee, in the William Cooper Survey, Leon County. This test is on a different structure from that to the southwest on which the operators have two producing gas wells.

E. L. Smith has assembled a block of 4,000 or 5,000 acres in the E. M. Brown, J. Sanches, D. Parker, E. Stokes, Foreman, Varnell and other adjacent surveys lying southeast of Dew and centering around the Stokes Survey.

W. C. McLaughlin, who has assembled several blocks and been instrumental in drilling a couple of tests in Henderson and Anderson Counties, has assembled a block of about 12,000 acres northeast of Trinidad, centering around the Vincent Michellia Survey and is to drill three or four tests. F. B. Payne Drilling Co. of Dallas has contracted to do the drilling.

T. C. Hadley has assembled a block on the Steen Saline salt dome, about 18 miles north and west of Tyler and 5 miles east of Lindale in Smith County, and is to start a test in 90 days after completion of the block.

The Overton Refining Co. of Overton has assembled a block 1½ miles southwest of Silver Lake and 4½ miles east of Grand Saline in Van Zandt County. The block centers around the M. A. Walker and J. H. Rhodes Survey. A dry hole was formerly drilled in the vicinity by the Clifford Oil Co.

Practically every major company has geophysical crews working in the counties of Anderson, Henderson, Freestone, Madison, Navarro and Leon, in the southern tier of East Texas counties, and also in Rains and Wood Counties in the northern part of the district. Many tests are due to be drilled within a few months, companies and independents taking blocks for drilling, while other blocks held for three or four or more years will now be tested.

East Central Texas Wildcats

Week Ending May 7

ANDERSON COUNTY

Company, well, farm name, section and block—	Remarks
Harry Bass et al's No. 1 J. A. Campbell, 467 ft. from N and W lines of 151.30-ac. tract, James Wilson Sur.	Location.
Barnsdall Oil Co.'s No. 1 W. L. Tubbs, 467 ft. from W line and center of N and S lines of 40-ac. tract, Samuel Edmondson Sur.	Location.
Pete Burton et al's No. 1 Freeman Baptist Church, 105 ft. due W of NW cor. of W. Chancellor Sur. in center of a 2-ac. tract, W. T. Meredith Sur.	Location.
Byrd-Frost et al's No. 1 Alice Scott, 1,200 ft. from N and 700 ft. from E lines of Joseph Crawford Sur., 1¼ miles NW of Slocum	Showed salt wtr. with some oil; T.D. 5,500 ft.
Byron and Jameson's No. 1 S. N. Price, 330 ft. from S and E lines of S. N. Price 60-ac. tract, Juan Y'Barbo Sur., 2 miles NE of Blackfoot	Set surface csg.; T.D. 327 ft.
Hill and Hill's No. 1 W. L. Tubbs, 466 ft. from W line and 470 ft. from S line of 40-ac. tract, Samuel Edmondson Sur.	Drlg. 3,969 ft.; top Austin chalk 3,330 ft.; base 3,708 ft.; top sand 3,883 ft.
Texas Seaboard Oil Co. and Tide Water Oil Co.'s No. 2 Edens, 1,400 ft. from E line and 2,333 ft. N of S line of Samuel Snider Sur.	Rig up.
Texas Seaboard Oil Co. and Tide Water Oil Co.'s No. 2 Nannie Wills, 1,400 ft. E of W line and 467 ft. S of N line of Wills tract, Samuel Edmondson Sur.	Drlg. 650 ft.
Texas Seaboard Oil Co. and Tide Water Oil Co.'s No. 3 Wills, 1,201 ft. from W line and 1,481 ft. from S line of Tract No. 2, Samuel Edmondson Sur.	Drlg. 3,532 ft.
Tide Water Oil Co. and Texas Seaboard Oil Co.'s No. 1 L. A. Rampy, 467 ft. from S and W lines of Rampy 103.38-ac. tract, James Wilson Sur.	T.D. 4,112 ft.; plugged back to 4,065 ft.; now testing.

CHEROKEE COUNTY

A. R. Lewis et al's No. 1 J. Bradford, 1,400 ft. from W line and 200 ft. from N line of 50-ac. tract, J. Laprella Sur.	Drlg. 2,050 ft.
A. F. Richardson's No. 1 P. Wood, 460 ft. from N line, 3,800 ft. from E line of 498-ac. tract, 14 miles E of Jacksonville, on Cherokee-Rusk County line, Ignacio Sanches Sur.	Derrick.
T. J. Wood et al's No. 1 New Birmingham, 660 ft. from S and E lines of 1,128-ac. tract, 7 miles SW of Rusk, Levi Jordan Sur.	Drlg. 1,926 ft.

(Continued on Page 170)

EAST TEXAS FIELD

Two hundred and forty-six permits were issued at Austin this week for wells to be drilled in the East Texas Field, but there were only 78 locations staked, the other permits to be absorbed by later locations. Of the permits, 156 went to independents and to major companies. Independent operators who are considering selling their leases are drilling as many wells as possible to reap the benefit of the high per well prices the larger companies are paying for East Texas properties. Some properties have brought even more than $60,000 per well. The number of acres seems to be of no consideration, all properties apparently being turned on a per well basis.

There are now over 13,100 producers in the field with the well per acre average down to around 8.5 per cent. It may be brought as low as one well to every 5 acres. Eighty-six wells were completed this week. The State Supreme Court is to rule on whether the well spacing outlined by the commission should be set aside or exceptions granted as often asked for by operators, which has almost nullified the spacing rule in East Texas.

The northern tip of the field was extended 2,000 feet to the east this week when T. D. Humphrey's No. 1 Mrs. Lulu Baker, in the James P. Price Survey, Gregg County, came in making a small pumper at total depth of 3,633 feet. There seems to be no end of the possibilities for extensions, the southern end still being undefined, especially so far as production of gas is concerned.

Refinery Law Upheld

An important Federal court decision was handed down by Judge Randolph Bryant at Sherman this week when he upheld the validity of oil proration regulations pertaining to refineries. He denied the application of the Arrow Refining & Producing Co. for an injunction restraining the Railroad Commission from enforcing two of its orders and the law passed by the recent session of the legislature to strengthen the proration laws by requiring refiners to make reports. This decision strengthens the position of the commission, leaving but few alibis for not enforcing its orders and putting a stop to the production and transportation of illegally produced oil.

Independent operators, company representatives, landowners, royalty owners and others interested in the East Texas Field and the oil industry, will meet at Tyler Tuesday to discuss and check the activities of the Railroad Commission and attorney general's department regarding the production and transportation of "hot oil" during the past four weeks, that time having elapsed since an ultimatum was issued to appreciably stop the flow of hot oil or Federal control would be sought by those who have taken an active interest in curtailing illegal production in the field. The oil committee of the East Texas Chamber of Commerce and Texas Petroleum Council and the Dallas Chamber of Commerce took the lead in the request for a change in the commission's forces with the hope of seeing a curtailment of "hot oil." Ap-

INVITATION

To the Eighth

INTERNATIONAL PETROLEUM EXPOSITION AND CONGRESS

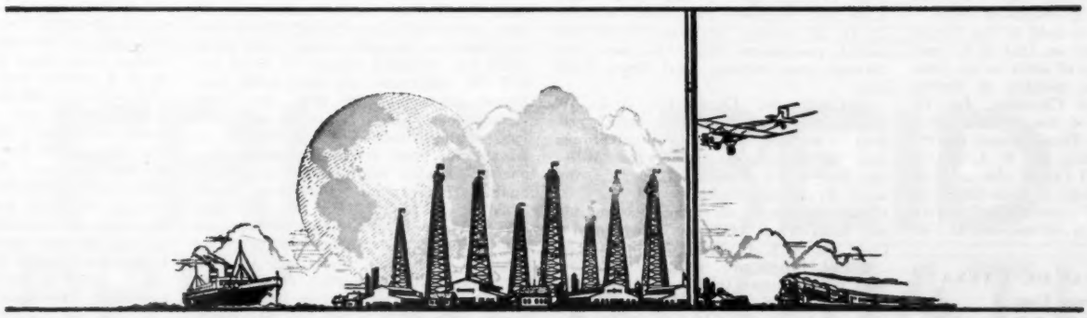
Tulsa, Oklahoma
May 12th to 19th, 1934

See the Interesting "Tailor-Made" Exhibit

by

SKELLY OIL COMPANY

Producer . . . Refiner . . . Transporter . . . Marketer



parently little change has taken place although many statements have been issued to the contrary. The East Texas Oil Landowners' Association this week wired their United States senators and congressman the endorsement of Federal oil control. They said: "No orderly production in East Texas, and hot oil moving in practically as large quantities as ever."

The attorney general's department obtained several more injunctions against operators this week, but is now in a serious situation in regard to the prosecution of some cases since the Railroad Commission discharged some employes who had been investigators and who alone can be witnesses in several cases against alleged violators, but now cannot be located to bring into court to testify.

Properties Purchased

Freeman Burford, president of the East Texas Oil & Refining Co., which recently sold its producing properties in the field to the Magnolia Petroleum Co., has again entered the producing list under the name of the Eastern Texas Oil Producing Co. It exercised its old option on the Weiss properties in the J. Armendaris Survey held by the Invincible Oil Co., and has purchased a half interest in the same company's 21-acre Williams lease in the G. F. Penn Survey, Gregg County. The East Texas Refining Co. has one of its refineries under lease to some independents, but has its largest refinery, at Longview, and one at Friars Switch to operate. It also has over 100 miles of gathering system.

Atlantic Oil Producing Co. has purchased the six-acre Ella Hagler lease in the J. S. Carruthers Survey, Gregg County, from the Edson Petroleum Co. The lease contains one well. Salmon Oil Co. purchased the 25-acre Lula Martin lease in the T. Johnson Survey, with three wells from an independent by the name of Koberg.

Stanolind Oil & Gas Co. purchased Nash and Windfohr's 30-acre Jones lease in the G. W. Hooper Survey, with four wells and also the 20-acre Jones lease with two wells from the Amada Petroleum Co. in the Hooper Survey. It formerly purchased the same company's A. J. Green lease in the same survey.

Shell Petroleum Corp. purchased Lion Oil & Refining Co.'s 240 acres of leases with 29 wells in Rusk County for a consideration reported as $1,800,000. This makes the per well price over $62,000.

Humble Oil & Refining Co. is purchasing small leases in the field, having purchased four small leases in the M. J. Pru Survey, Rusk County, which contain one well to each tract.

Reclamation Suit

The trial of the suit of the reclaiming plants against the Railroad Commission, due for hearing on April 26 before Federal Judge Randolph Bryant, has been postponed indefinitely. The Reclamation Oil Co. and 13 other oil reclaiming companies sought to restrain the commission from charging "waste oil" taken from tank bottoms, creeks and ditches against leases from which it originally came.

A hearing is to be held at the Blackstone Hotel in Tyler on May 9 to hear cost data on drilling of wells in the East Texas Field or the counties of Smith, Gregg, Upshur and Cherokee. Joe H. Russell, chairman of the drilling practices committee for Texas, issued the request for the meeting. D. E. Legan of the Tide Water Oil Co. is chairman of the East Texas zone subcommittee of drilling practices. The committee includes E. L. Smith, John R. Black and H. W. Bass.

COMPLETIONS IN EAST TEXAS

North Gregg County

Adams and Lyles' No. 9 Taylor Anderson, top sand 3,480 feet, initial production 25 bbls. in one-quarter hour through open tubing, total depth 3,510 feet. Arkansas Fuel Oil Co.'s No. 6 G. A. Castleberry, top sand 3,622 feet, initial production 33 bbls. in one-half hour through open tubing, total depth 3,635 feet; No. 3 L. Walker, top sand 3,625 feet, initial production 32 bbls. in one-quarter hour through open tubing, total depth 3,650 feet. Atlantic Oil Producing Co.'s No. 17 W. P. Duncan, top sand 3,641 feet, initial production 110 bbls. per hour through open tubing, total depth 3,700 feet. Stroube-Black and Collins' No. 45 Spurrier, top sand 3,500 feet, initial production 100 bbls. per hour through open tubing, total depth 3,536 feet. Bond and Johnson's No. 5 Foster, top sand 3,573 feet, initial production 100 bbls. per hour through open tubing, total depth 3,591 feet. Empire Gas & Fuel Oil Co.'s No. 4 L. A. Jeter, top sand 3,530 feet, initial production 32 bbls. in one-quarter hour through open tubing, total depth 3,573 feet. Faith Oil Co.'s No. 6 B. B. Fenton, top sand 3,732 feet, initial production 40 bbls. in one-half hour through open tubing, total depth 3,759 feet.

Gulf Production Co.'s No. 19 S. C. Fishburn, top sand 3,516 feet, initial production 72 bbls. per hour through open tubing, total depth 3,546 feet; No. 29 M. O. Sheppard, top sand 3,490 feet, initial production 80 bbls. per hour through open tubing, total depth 3,522 feet. H. L. Johnson's No. 3 Hineman, top sand 3,638 feet, initial production 20 bbls. in one-quarter hour through open tubing, total depth 3,663 feet. Foster Jones' No. 1 J. R. Smith, temporarily abandoned, total depth 3,681 feet. Lechner and Hubbard's No. 4 J. B. Doby, top sand 3,469 feet, initial production 50 bbls. in 20 minutes through open tubing, total depth 3,515 feet; No. 6 McGrede, top sand 3,644 feet, initial production 40 bbls. in 20 minutes through open tubing, total depth 3,663 feet. Lucey Petroleum Co.'s No. 5 M. Fisher, top sand 3,521 feet, initial production 10 bbls. in one-quarter hour through open tubing, total depth 3,558 feet. Magnolia Petroleum Co.'s No. 13 H. B. Ziegler, top sand 3,446 feet, initial production 135 bbls. per hour through open tubing, total depth 3,482 feet.

McCurdy and Carr's No. 5 J. W. Richey, top sand 3,510 feet, initial production 40 bbls. in one-half hour through open tubing, total depth 3,530 feet. Miller and Lacy's No. 3 W. R. Nicholson, top sand 3,669 feet, initial production 52 bbls. in one-half hour through open tubing, total depth 3,698 feet. Navarro Oil Co.'s No. 8 T. D. Harris, top sand 3,499 feet, initial production 40 bbls. per hour through open tubing, total depth 3,521 feet. W. S. Randall's No. 2 L. M. Colburn, top sand 3,516 feet, initial production 100 bbls. per hour through open tubing, total depth 3,553 feet. Satellite Oil Co.'s No. 6 Colburn, top sand 3,552 feet, initial production 125 bbls. per hour through open tubing, total depth 3,597 feet. Standard of Kansas' No. 2 J. W. Fuller, top sand 3,632 feet, initial production 60 bbls. per hour through open tubing, total depth 3,675 feet. Superior Oil Co.'s No. 9 Jones, top sand 3,585 feet, initial production 45 bbls. in one-quarter hour through open tubing, total depth 3,651 feet. Yount Lee Oil Co.'s No. 6 Custer, top sand 3,543 feet, initial production 58 bbls. per hour through eleven-sixteenths inch tubing choke, total depth 3,559 feet; No. 4-B F. K. Lathrop, top sand 3,574 feet, initial production 61 bbls. per hour through eleven-sixteenths inch tubing choke, total depth 3,595 feet.

South Gregg County

Atlantic Oil Producing Co.'s No. 11 M. Whaley, top sand 3,644 feet, initial production 90 bbls. per hour through open tubing, total depth 3,652 feet. Ben G. Barnett's No. 1 S. B. Wells, top sand 3,532 feet, initial production 50 bbls. per hour through open tubing, total depth 3,597 feet. W. W. Bradley's No. 2 M. T. Cole, top sand 3,548 feet, initial production 140 bbls. per hour through open tubing, total depth 3,555 feet; No. 3 M. T. Cole, top sand 3,542 feet, initial production 140 bbls. per hour through open tubing, total depth 3,558 feet. Clopton and Lewis' No. 2 Southworth, top sand 3,541 feet, initial production 10 bbls. in seven minutes through open tubing, total depth 3,552 feet. DeArman and McMillan's No. 2 Strong, top sand 3,657 feet, initial production 15 bbls. in 12 minutes through open tubing, total depth 3,663 feet. Empire Gas & Fuel Co.'s No. 7 E. Muckelroy, top sand 3,527 feet, initial production 90 bbls. per hour through open tubing, total depth 3,577 feet; No. 72 L. Taylor, top sand 3,699 feet, initial production 25 bbls. in one-quarter hour through open tubing, total depth 3,710 feet.

Galvez Oil Co.'s No. 7 M. T. Cole, top sand 3,547 feet, initial production 20 bbls. in one-half hour through 1-inch tubing choke on 2½-inch tubing, total depth 3,573 feet. General Crude Oil Co.'s No. 6 J. M. Blackman, top sand 3,598 feet, initial production 85 bbls. per hour through open tubing, total depth 3,606 feet. Gulf Production Co.'s No. 22 C. Brown, top sand 3,498 feet, initial production 63 bbls. per hour through three-quarters inch tubing choke, total depth 3,525 feet; No. 8 L. D. Crim, top sand 3,573 feet, initial production 80 bbls. per hour through open tubing, total depth 3,608 feet; No. 28 A. Spear, top sand 3,538 feet, initial production 60 bbls. per hour through three-quarters inch tubing choke, total depth 3,568 feet. Hawkeye Petroleum Co.'s No. 4 W. Smith, top sand 3,586 feet, initial production 120 bbls. per hour through open tubing, total depth 3,627 feet.

Humble Oil & Refining Co.'s No. 12 D. Thomas, top sand 3,530 feet, initial production 87 bbls. per hour through open tubing, total depth 3,604 feet. Rogers Lacey's No. 3 J. T. Reynolds, top sand 3,522 feet, initial production 40 bbls. per day swabbing, total depth 3,537 feet. Magnolia Petroleum Co.'s No. 19 John Radford, top sand 3,641 feet, initial production 20 bbls. in one-quarter hour through open tubing, total depth 3,642 feet. Shell Petroleum Corp.'s No. 18-A B. F. Laird, top sand 3,586 feet, initial production 21 bbls. in 20 minutes through open tubing, total depth 3,609 feet. Sinclair Prairie Oil Co.'s No. 36-A A. A. King, top sand 3,458 feet, initial production 30 bbls. in one-quarter hour through open tubing, total depth 3,500 feet. Sun Oil Co.'s No. 7 J. S. Snider, top sand 3,542 feet, initial production 65 bbls. per hour through open tubing, total depth 3,577 feet. Trans-State Oil Co.'s No. 6 J. B. Watson, top sand 3,584 feet, initial production 40 bbls. in 14 minutes through open tubing, total depth 3,611 feet. Southport Petroleum Co.'s No. 2 I.&G.N.R.R., top sand 3,533 feet, initial production 20 bbls. per day with air lift, total depth 3,568 feet.

Houston Oil Co.'s No. 2-A Nat Bean, top sand 3,575 feet, initial production 102 bbls. per hour through open tubing, total depth 3,592 feet. McMahan and Dunning's No. 5 J. N. Peterson, top sand 3,626 feet, initial production 45 bbls. in 40 minutes through 1½-inch tubing choke, total depth 3,644 feet. Magnolia Petroleum Co.'s No. 7 Nat Bean, top sand 3,505 feet, initial production 10 bbls. in 10 minutes through 1-inch tubing choke on 2½-inch tubing, total depth 3,555 feet; No. 8 Nat Bean, top sand 3,534 feet, initial production 8 bbls. in one-quarter hour through 1-inch tubing choke, total depth 3,580 feet. Stanolind Oil & Gas Co.'s No. 8 J. S. Powers, top sand 3,701 feet, initial production 30 bbls. in one-half hour through open tubing, total depth 3,703 feet. Upchurch & Co.'s No. 4 W. P. Brightwell, top sand 3,602 feet, initial production 100 bbls. per hour through open tubing, total depth 3,612 feet. Woodley Petroleum Co.'s No. 6-A J. Ladd, top sand 3,602 feet, initial production 80 bbls. per hour through open tubing, total depth 3,608 feet.

South Rusk County

Dearing & Son's No. 4 A. P. Finney, top sand 3,661 feet, initial production 15 bbls. per hour by heads, total depth 3,680 feet. Fair and Thompson's No. 3-A W. E. Wiley, top sand 3,583 feet, initial production 25 bbls. per hour through open tubing, total depth 3,612 feet. Gulf Production Co.'s No. 3 W. D. Perry, top sand 3,651 feet, initial production 11 bbls. per hour through three-quarters inch tubing choke, total depth 3,663 feet. Harry Hanbury's No. 3 M. L. Thompson, top sand 3,686 feet, initial production 60 bbls. per hour through open tubing, total depth 3,750 feet. Hanna and Stevens' No. 1 J. H. Henson, top sand 3,511 feet, initial production 20 bbls. in three hours' pumping, total depth 3,650 feet. Haynes Drilling Co.'s No. 11 Clark Lee, top sand 3,614 feet, initial production 45 bbls. in 18 minutes through open tubing, total depth 3,645 feet. Humble Oil & Refining Co.'s No. 9-B Ida Holt, top sand 3,706 feet, initial production 39½ bbls. in one-half hour through open tubing, total depth 3,757 feet; No. 40-A R. E. L. Silvey, top sand 3,712 feet, initial production 90 bbls. per hour through three-quarters inch tubing choke, total depth 3,777 feet; No. 11-B H. White, top sand 3,658 feet, initial production 58 bbls. per hour through open tubing, total depth 3,725 feet.

Lone Pine Oil Co.'s No. 2-A L. J. Pinkston, top sand 3,644 feet, initial production 60 bbls. per hour through open tubing, total depth 3,652 feet. Louisiana Oil & Refining Co.'s No. 3 H. Kirsch, top sand 3,604 feet, initial production 110 bbls. per hour through open tubing, total depth 3,609 feet. McMurray and Fair's No. 5 R. W. Fair, top sand 3,670 feet, initial production 85 bbls. per hour through open tubing, total depth 3,678 feet. Overton Refining Co.'s No. 2 Ras Redwine, top sand 3,548 feet, initial production 20 bbls. in 45 minutes swabbing, total depth 3,630 feet. G. I.

Left to right: W. T. Sims, superintendent and E. W. Ellis, chemist, both with the Panhandle Refining Co., Wichita Falls, Texas

A FRIENDLY WELCOME

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8th INTERNATIONAL PETROLEUM EXPOSITION

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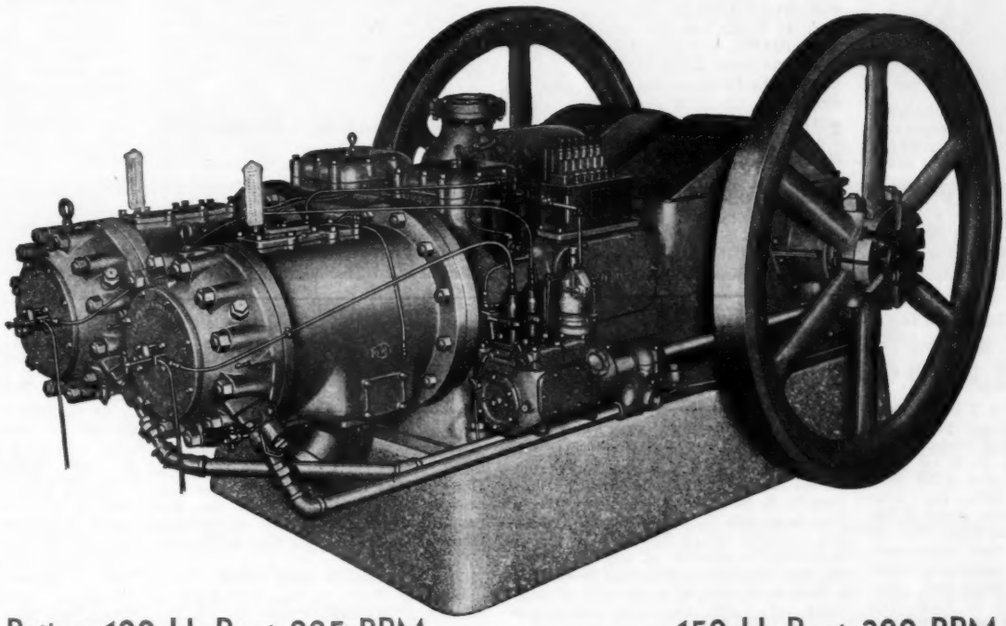

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SUPPLY CORPORATION

PITTSBURGH, PA. TULSA, OKLA.

Reeves' No. 2 W. H. Frederick, top sand 3,557 feet, initial production 20 bbls. per hour through open tubing, total depth 3,600 feet. Seagull Oil Corp.'s No. 2 E. A. Thrash, top sand 3,641 feet, initial production 40 bbls. per hour through open tubing, total depth 3,695 feet. Slaughter and others' No. 3 W. H. Frederick, top sand 3,583 feet, initial production 20 bbls. per hour swabbing, total depth 3,650 feet. Octo Oil Co.'s No. 1 Stroube, top sand 3,541 feet, initial production 30 bbls. in two hours through 2½-inch tubing, total depth 3,645 feet. R. S. Vise's No. 4 Alford, top sand 3,857 feet, initial production 25 bbls. in one-quarter hour through open tubing, total depth 3,861 feet. Ward Oil Co.'s No. 3 J. Cox, top sand 3,682 feet, initial production 25 bbls. per hour by heads, total depth 3,763 feet.

O. P. Wegner, engineer in charge of equipment for the Argentine government oil fields (right), with headquarters in New York and T. L. Putnam, (left), export representative of the W-K-M Company, Inc., New York. Mr. Wegner will be in Tulsa during the International Petroleum Exposition

Smith County

Graham and others' No. 2 S. S. Cook, top sand 3,764 feet, initial production 150 bbls. per hour through open tubing, total depth 3,768 feet. K. O. T. Oil Co.'s No. 3 S. S. Cook, top sand 3,724 feet, initial production 90 bbls. per hour through open tubing, total depth 3,730 feet. Magnolia Petroleum Co.'s No. 12 Loosier, top sand 3,658 feet, initial production 23 bbls. in 10 minutes through open tubing, total depth 3,670 feet. Manahan Oil Co.'s No. 4 S. S. Cook, top sand 3,748 feet, initial production 90 bbls. per hour through open tubing, total depth 3,757 feet. J. M. Rush's No. 1 S. S. Cook, top sand 3,755 feet, initial production 100 bbls. per hour through open tubing, total depth 3,757 feet.

Upshur County

Clark and Cowden's No. 2 J. W. Free, top sand 3,670 feet, initial production 75 bbls. per hour through open tubing, total depth 3,706 feet. Conservative Oil Co.'s No. 2 Phillips, top sand 3,704 feet, initial production 15 bbls. in 20 minutes by heads, total depth 3,715 feet.

Humble Oil & Refining Co.'s No. 16 W. W. Holland, top sand 3,593 feet, initial production 76 bbls. through three-quarters inch tubing choke, total depth 3,623 feet. Mudge Oil Co.'s No. 9-A S. E. Richardson, top sand 3,724 feet, initial production 85 bbls. per hour through open tubing, total depth 3,745 feet. Peckham Oil Co.'s No. 6 T. Wells, top sand 3,705 feet, initial production 30 bbls. in one-half hour through open tubing, total depth 3,716 feet.

WILDCAT COMPLETIONS

Leon County

Tide Water Oil Co. and Texas Seaboard Oil Co.'s No. 1 G. W. Burkett, location abandoned.

Nacogdoches County

Elm Oil Co.'s No. 1 J. L. Ayers, top Pecan Gap 2,968 feet, base 3,565 feet, top Austin chalk 3,960 feet, base 4,033 feet, top Georgetown lime 4,130 feet, dry and abandoned, total depth 4,177 feet (J. Weeks Survey).

Van Zandt County

J. D. Wrather's No. 1 G. W. Carter, top Pecan Gap, 1,610 feet, base 1,764 feet, top Austin chalk 2,575 feet, base 2,718 feet, top Red Beds 2,863 feet, junked and abandoned, total depth 2,910 feet (William Daniel Survey).

Van Pool—Van Zandt County

Pure Oil Co.'s No. 3 W. F. Swain, initial production 123 bbls. on proration gauge, total depth 2,958 feet; No. 10 Ella York, initial production 25 bbls. on proration gauge, total depth 2,941 feet.

West Texas Fields

(Continued from Page 64)

Survey, Moore County, was completed for a 28,000,000-foot gas well after being plugged back from a total depth of 3,610 feet.

In Wheeler County, Piney Oil & Gas Co.'s No. 1 Williams, Section 6, Block 24, H.&G.N. Survey, was completed for 70,700,000 feet of gas from pay topped at 1,839 feet. It is bottomed at 2,052 feet. Same company's No. 1 Mankins, Section 54, Block 13, H.&G.N. Survey, was drilled to 2,216 feet and plugged back to 2,212 feet and was completed for a 100-bbl. well after being shot with 30 quarts from 2,204-10 feet.

With the large number of completions each week, the daily average production continues to ride above the allowable of 52,000 bbls. Last week's daily average production was 57,750 bbls., a slight decrease.

Humble Oil & Refining Co.'s No. 1 Smith, an Ordovician wildcat in Childress County, has drilled below 1,862 feet. Halliburton Co. recently completed cementing the 13⅜-inch pipe, the longest string of big pipe in the district. The rotary equipment being used is the heaviest in the district and has been built especially for the drilling of the test which is expected to go to at least 8,000 feet.

Skelly Oil Co. recently completed the purchase of 3,400 acres in Wheeler County from the Pendleton and Vaughn interests of Shamrock. The acreage lies in the oil trend extending from the vicinity of Twitty to a point near Shamrock. The company has made a location in Section 5, Block A, 8 miles west of Twitty.

COMPLETIONS IN NORTH TEXAS

Archer County

Bridwell Oil Co.'s No. 25 Investment Co., dry and abandoned, total depth 1,496 feet; No. 8 Logan, lime 1,131-50 feet, initial production 250 bbls., total depth 1,150 feet, treated with acid. Bridwell Oil Co. and Continental Oil Co.'s No. 9 Logan, lime 1,123-37 feet, initial production 75 bbls., total depth 1,137 feet, treated with acid. C. W. Carey's No. 4-E Falls County School Lands, lime 1,193-12 feet, initial production 53 bbls. in 12 hours, total depth 1,200 feet, treated with acid. Continental Oil Co.'s No. 2-A Falls County School Land, dry and abandoned, total depth 320 feet. F. P. Cullum's No. 6 Logan, lime 1,160-74 feet, initial production 90 bbls., total depth 1,174 feet, treated with acid; No. 7 Logan, lime 1,155-68 feet, initial production 75 bbls., total depth 1,168 feet, treated with acid; No. 8 Logan, lime 1,156-70 feet, initial production 125 bbls., total depth 1,170 feet, treated with acid. Fain and McGaha's No. 5 Falls County School Lands, lime 1,109-21 feet, initial production 150 bbls., total depth 1,121 feet, treated with acid; No. 87 Logan, lime 1,128-40 feet, initial production 800 bbls., total depth 1,140 feet, treated with acid.

Golding and Cochran's No. 10 Lauster, dry and abandoned, total depth 1,312 feet. J. C. Hamer's No. 2 Longley, oil sand 964-72 feet, initial production 8 bbls., total depth 972 feet. W. B. Hamilton's No. 30 Abercrombie, lime 1,166-77 feet, initial production 80 bbls. per hour, total depth 1,177 feet, treated with acid; No. 13 Ikard, lime 1,154-66 feet, initial production 104 bbls., total depth 1,166 feet, treated with acid. R. L. Hays and others' No. 1 Lauster, dry and abandoned, total depth 1,343 feet. Humble Oil & Refining Co.'s No. 2-A Longley, dry and abandoned, total depth 1,228 feet. Krahenbuhl and Bradley's No. 2 Canington, lime 1,187-95 feet, initial production 12 bbls., total depth 1,195 feet. W. F. Krouse's No. 1 Scott, dry and abandoned, total depth 1,032 feet.

W. E. Maxon, Jr.'s No. 19 Green, lime 1,081-97 feet, initial production 80 bbls., total depth 1,097 feet, treated with acid. Paul J. McIntyre's No. 1 Green, dry and abandoned, total depth 1,180 feet. Perkins and Cullum's No. 6-A Falls County School Land, lime 1,094-1,103 feet, initial production 25 bbls. per hour, total depth 1,103 feet, treated with acid; No. 19 Hanzen, lime 1,092-1,104 feet, initial production 60 bbls. per hour, total depth 1,104 feet, treated with acid; No. 20 Hanzen, lime 1,080-1,104 feet, initial production 70 bbls. per hour, total depth 1,104 feet, treated with acid. Petroleum Producers Co.'s No. 1-E Richardson, oil sand 1,245-53 feet, initial production 125 bbls., total depth 1,253 feet, treated with acid. Pois and Schultz's No. 13 Green, lime 1,138-56 feet, initial production 200 bbls., total depth 1,156 feet, treated with acid. Shappell Oil Co.'s No. 2 Jones, dry and abandoned, total depth 1,207 feet. Stainforth and Ray's No. 5 Wilson, oil sand 1,600-06 feet, initial production 600 bbls., total depth 1,606 feet. Tex-Ho Oil Co.'s No. 1 Anderson, lime 1,411-22 feet, initial production 25 bbls. per hour, 20 per cent water, total depth 1,422 feet, treated with acid. Whatley and Whatley's No. 1 Justice, lime 1,086-98 feet, initial production 25 bbls., total depth 1,098 feet. D. L. Wolf's No. 4 Andrews, dry and abandoned, total depth 900 feet. W. C. Young's No. 3 Foster, dry and abandoned, total depth 1,260 feet.

Jack County

T. M. McDaniels' No. 1 Bloodworth, oil sand 268-77 feet, initial production 8 bbls., total depth 277 feet.

Montague County

O. E. Beck and H. E. Crenshaw's No. 1, dry and abandoned, total depth 3,500 feet.

Wichita County

Darby-Lynde's No. 13 Overby, oil sand 802-04 feet, initial production 5 bbls., total depth 804 feet. Wayne Harmon's No. 15 Mitchell, lime 1,193-95 feet, initial production 100 bbls. of oil and 100 bbls. of salt water, total depth 1,795 feet. Peckham and Medder's No. 1-A W. T. Waggoner, lime 1,871-76 feet, initial production 28 bbls., total depth 1,876 feet, treated with acid. Regal Oil Co.'s No. 1 Allen Kemp, dry and abandoned, total depth 450 feet. Reno Oil Co.'s No. 1 W. T. Waggoner, dry and abandoned, total depth 2,409 feet. Texas Plains Oil Co.'s No. 1 W. T. Waggoner, dry and abandoned, total depth 2,185 feet.

Wilbarger County

Golding and Cochran's No. 1-P Waggoner, dry and abandoned, total depth 2,000 feet. J. H. Massie's No. 1-H W. T. Waggoner, abandoned location. Phillips Petroleum Co.'s No. 1-B B. Waggoner, lime 2,554-62 feet, initial production 58 bbls., total depth 2,562 feet.

Young County

T. G. Shaw Oil Corp.'s No. 3 Marshall, oil sand 884-95 feet, initial production 150 bbls., total depth 895 feet. J. H. Kleiner's No. 3 Kirkland, dry and abandoned, total depth 740 feet. Nash and Windfohr's No. 8 Graham-Vick, oil sand 2,665-88 feet, initial production 85 bbls., total depth 2,688 feet. S. H. Simmons' No. 2 Shotto, dry and abandoned, total depth 550 feet. Texas Plains Oil Co.'s No. 1-B Finch, dry and abandoned, total depth 715 feet. Wheeler and Brashear's No. 1 Rogers, dry and abandoned, total depth 1,102 feet.

PIPE LINE CONSTRUCTION

JACKSON COUNTY, TEXAS, LINE

HOUSTON, Tex., May 7.—Humble Pipe Line Co. is building a loading rack on the Missouri Pacific Railroad at Vanderbilt, Jackson County, and is laying a line from this to connect with a wildcat producer which Encino Gas Co. is completing a mile out of town. The well has not been brought in but results of a drill stem test of a sand at a total depth of 5,582 feet were conclusive enough to indicate the existence of a field. The oil will be bought by Humble Oil & Refining Co.

LINE FROM PLEDGER FIELD

HOUSTON, Tex., May 7.—Plans for the laying of a 10-inch welded gas line from the Pledger Field, Brazoria County, to Houston, a distance of approximately 50 miles have been made known here by Harry Pennington, head of the natural gas division of the Paramount Natural Gasoline Co.

The Paramount company, which is affiliated with the Danciger Oil & Refining Co., owner and developer of the Pledger Field, operates a gasoline plant, recently completed at that field.

The proposed line, which according to present plans, will serve only industrial users, will have an estimated capacity of 50,000,000 feet daily and will cost in the neighborhood of $445,000. It is reported pipe already has been ordered and that work on two river crossings, the Brazos and the San Bernard, will be started within four weeks, the laying of the rest of the line to follow that.

Danciger Oil & Refining Co. already has completed three high pressure gas wells at Pledger in the consistent development program which the company has under way. Indications point to a tremendous gas reserve at that field.

Gas systems of two other groups already serve Houston, these being the Houston Pipe Line Co. and Houston Natural Gas Co., and the United Gas System, distributing subsidiary of which in Houston is the Houston Gas & Fuel Co.

BOWDOIN GAS LINE

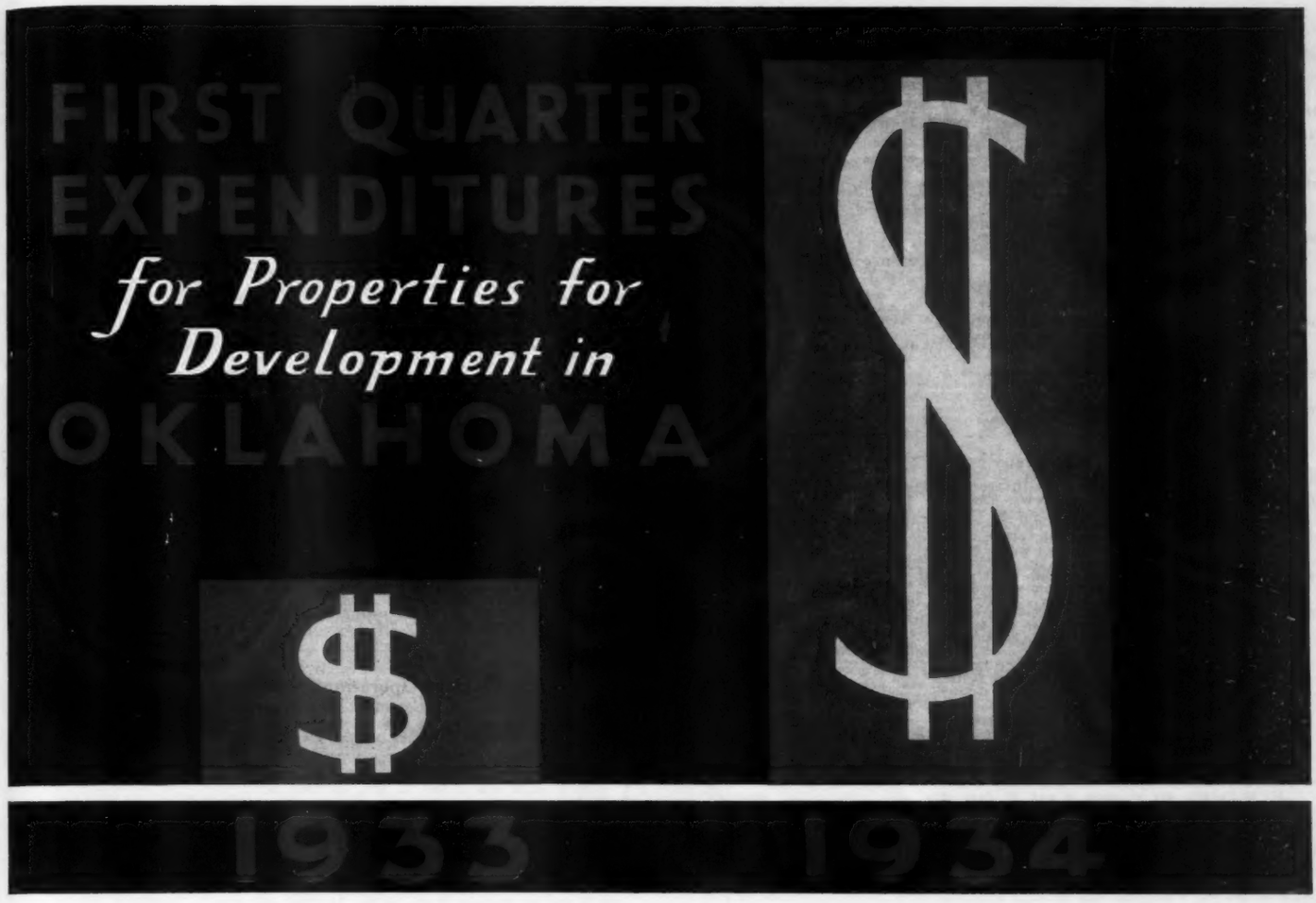
Bowdoin Utilities Co., subsidiary of Minnesota Northern Power Co., is laying a 19-mile 8-inch natural gas line from the Bowdoin Field to the construction site of the $70,000,000 dam being built across the Missouri River at Fort Peck in northeastern Montana. The line is being laid of 120-foot welded pipe sections, joined by heavy Dresser couplings.

ORDERS FOR PIPE

Two large orders for Naylor Spiral Weld Pipe for gas lines have been booked by Naylor Pipe Co., Chicago, according to a recent announcement by E. W. Hough, vice president and director of sales. Five miles of 16-inch pipe will be required for a gas vacuum line for the Phillips Petroleum Co., Burbank, Okla. Several miles of 16-inch pipe will be used for a pressure gas line of American Natural Gasoline Co., Shamrock, Tex.

PIPE LINE FLOW SUBCOMMITTEE

The work of the Pipe Line Flow Subcommittee is being continued during the present year in co-operation with the Bureau of Mines. The engineers of the Bureau of Mines who have conducted the field experiments and reported upon them are now engaged in the preparation of a final Bureau of Mines bulletin which will constitute the formal report on the entire flow problem.



Leasing Activity in Oklahoma Shows HUGE Advance Over 1933

The prediction of oil geologists a year ago that great additional oil development could be expected in Oklahoma—is now being borne out in fact.

A rough approximation of the trend has been obtained by selecting at random 12 oil companies operating in Oklahoma, and comparing their expenditures for Oklahoma production properties, new leases, rentals and renewals, in the first quarter of 1933, with their corresponding expenditures in the first quarter of 1934.

These 12 companies spent $2,184,768 for these purposes, in the first quarter of 1933. They spent $7,768,062, in the first quarter of 1934, or more than three and one-half times the 1933 expenditure.

It is also significant that these properties today are being acquired for actual development. Previously much of the acreage bought was acquired primarily as a matter of protection. The expenditures cited can be regarded as merely the initial expenditures in what will be complete development programs. These 12 companies were drilling 61 wells in Oklahoma on April 10th., 1933. On April 10th., 1934, they were drilling 132 wells and making preparations to drill many more.

Tulsa's position as the World Oil Capital is based on much more than production. Her location for 25 years at the heart of the nation's oil production activities caused her to become the hub of the nation's gigantic pipe line and refining network and the executive headquarters of nearly 500 producing, pipe line and refining companies, including 45 major companies. These companies have heavy investments in Tulsa office buildings. Their employes have heavy investments in Tulsa homes. They cannot move every time a new boom causes a slight shift in the center of oil production.

Yet it is highly significant that the exact center of Mid-Continent oil production is moving back towards Tulsa, at this time. Not only is production activity in Oklahoma rapidly advancing, but geologists now predict that the next great oil booms will occur in the states of Kansas and Nebraska, balancing up the recent and current developments in the southern part of the Mid-Continent.

The Mid-Continent produces 63% of the nation's oil. Tulsa is executive headquarters for this great activity, and purchasing headquarters for the equipment used. In normal years purchases of equipment in Tulsa have been estimated at $400,000,000. For the facts about Tulsa in greater detail address Tulsa Chamber of Commerce.

TULSA

Oil Capital of the World

East Central Texas Wildcats

(Continued from Page 164)

FANNIN COUNTY

L. Kean et al's No. 1 L. M. Boyd, 900 ft. from E line and 300 ft. from N line of survey, W. Hunt Sur. ....Drlg. 2,170 ft.

FREESTONE COUNTY

Clyde Creighton's No. 1 Holly Bros., 854 ft. from W and center N and S lines of lease, A.B.&M. Sur. .....Junked; T.D. 5,180 ft.

Daniels Oil & Royalty Co.'s No. 1 P. D. C. Ball, 10,330 ft. from S line and 1,980 ft. from W line of survey, Jose Ignacio Auguilera Sur. .....Waiting on cmt. to set; T.D. 4,877 ft.

Trinity Farm Co.'s No. 1 N. R. Stewart, 1,866 ft. SW from NE line and 933 ft. SE from NW line of 1,920-ac. tract, R. M. Williams Sur. .....Location.

GREGG COUNTY

Elsecp Oil Co.'s No. 1 G. S. Mattox, 3,460 ft. from N line and 1,200 ft. from W line of survey, D. Sanches Sur. .....Waiting on standard rig; T.D. 3,632 ft.

E. A. Lamb's No. 1 Clements, 500 ft. from W line and 1,380 ft. from N line of survey, G. A. Thomason Sur. .....Derrick.

Powderhorn Petroleum Co.'s No. 1 R. Stell, 6,300 ft. from W line and 100 ft. from N line of John Wilkerson Sur. .....Waiting on standard rig; T.D. 3,590 ft.

Sparkman and Reusch's No. 1 E. E. Stone, 1,000 ft. from E line and 330 ft. from N line of survey, M. Alexander Sur. .....Derrick.

Webster Oil & Gas Co.'s No. 1 Register, 856 ft. from S line and 1,450 ft. from W line of survey, G. F. Penn Sur. .....Waiting on cmt. to set; T.D. 2,400 ft.

HENDERSON COUNTY

H. A. Baker et al's No. 2 J. J. Dupuis, 250 ft. from S line, 250 ft. from E line of tract, Geo. Hancock Sur...Drlg. 2,420 ft. (new hole).

Big Bad Wolf Oil Co.'s No. 1 McCreary, 1,800 ft. from W line and 330 ft. from S line of survey, 6 miles S of Malakoff, W. H. Irvin Sur. .....Derrick.

Roy Black et al's No. 1 C. B. Meredith, 360 ft. from N and W lines of 64.5 ac. tract, 4 miles SE of Malakoff, Wiley Kay Sur. .....Rig up.

Campbell and Champlin's No. 1 R. S. Ansley, 198 varas S. 633 varas W of NE cor. of lease, 6 miles SE of Buffalo, N. H. Thompson Sur. .....Derrick.

Rector-Webb et al's No. 1 C. A. Riddlesperger, 225 ft. from S and W lines of 50-ac. lease out of 203-ac. tract, 10 miles SE of Malakoff, W. F. Mitcham Sur. .....S.D. 4,506 ft.

HUNT COUNTY

H. C. Waggoner et al's No. 1 Love, 300 ft. from N line, 4,800 ft. from W line of 95-ac. tract, John Gillisky Sur. .....Drlg. 2,765 ft.

KAUFMAN COUNTY

W. J. Lewis et al's No. 1 D. Clark, 430 ft. from S line and 660 ft. from E line of survey, 6½ miles NW of Elmo .....Spudding.

LAMAR COUNTY

Cole et al's (formerly Optometrist Oil Club) No. 1 J. M. McFaddin, 450 ft. from S and W lines of E 25-ac. tract, 10 miles NW of Paris, Joseph Dick Sur. .....S.D. 2,506 ft.

LEON COUNTY

Shell Petroleum Corp.'s No. 1 Lee, 1,500 ft. from NW and SW lines of farm and survey, William Cooper Sur. .....Prepare to set csg.; T.D. 6,040 ft.

MORRIS COUNTY

Simpson et al's No. 1 Staggers, 800 ft. from S line of survey and 150 ft. from W line of lease, J. B. Nelson Survey .....Drlg. 1,500 ft.

LIMESTONE COUNTY

C. M. Joiner et al's No. 1 S. A. Knobb, 900 ft. from N line and 1,000 ft. from W line of survey, one-half mile N of Falls County line, Luke Moore Sur. .....S.D. 1,700 ft.

J. Rodgers et al's No. 1 Vol DeLone, 1,516 ft. from W line and 400 ft. from N line of W 100-ac. tract, Pedro Varela Sur. .....Shut down.

NACOGDOCHES COUNTY

Dick Schwab et al's No. 1 Z. Rambain, 990 ft. from N line and 330 ft. from W line of 97.5-ac. tract, J. Simpson Sur. .....Drlg. 4,244 ft.

NAVARRO COUNTY

W. J. Keeling et al's No. 1 J. F. Rushing, 484 ft. from N line and 150 ft. from W line of 184-ac. tract, 6 miles SW of Richardson, Henry Ford Sur. .....Derrick.

J. B. Stoddard et al's No. 1 C. S. West estate, 1,000 ft. from W line and 650 ft. from N line of 642-ac. tract, Mathew Boren Sur., Abstract No. A-56 .....Rigging up.

RAINES COUNTY

J. W. Hallsell et al's No. 1 P. F. Jones, 400 ft. out of SW cor. of 22-ac. tract, 2½ miles S of Alba, B.B. B.&C. Sur. .....S.D. 1,632 ft.

RUSK COUNTY

Arnold and Shaw's No. 1 J. E. Arnold, 1,530 ft. from S line and 300 ft. from most southerly E line of survey, J. Crawford Sur. .....Derrick.

Bond Oil Corp.'s No. 1 Bradford, 5,900 ft. from W line and 6,300 ft. from S line of survey, Juan Ximenes Sur. .....T.D. 3,500 ft.

George Hudson et al's No. 3 Jeff Phillips, 150 ft. from N line of survey and 700 ft. from W line of 100-ac. tract, 4 miles SE of Minden, N. Villaria Sur. ....S.D. 2,736 ft.

Johnson et al's No. 1 L&G.N.R.R., 3,920 ft. from E line, 400 ft. from S line of survey, Wm. Kellen Sur. ....Rig up.

A. A. Oil Co.'s No. 1 Geo. Curbo, 1,900 ft. from S line, 330 ft. from E line of Wm. Christian Sur. .....Drlg. 1,908 ft.

Octo Oil Co.'s No. 1 E. Tipps, 2,750 ft. from S line and 7,400 ft. from W line of Juan Ximines Sur. .....Drlg. 1,060 ft.

Reed et al's No. 1 S. Lacy, 1,610 ft. from S line and 1,000 ft. from E line of survey, R. B. Tutt Sur. ....Set surface csg.

Sinclair Prairie Oil Co.'s No. 1 Kangerga Bros., 330 ft. from W and 300 ft. N of NW cor. of E. S. Van Sickel Sur. .....Derrick.

SMITH COUNTY

Preston Rose et al's No. 1 Elisha Wiggins, 2,300 ft. from W line and 330 ft. from S line of 640-ac. tract, 2 miles SW of Winona, F. H. K. Day Sur., Abstract No. 285 .....Derrick.

Texas Trading Co.'s No. 1 O. T. Ray, 330 ft. from S and W lines of E half of O. T. Ray 100-ac. tract, 10 miles SW of Tyler, M. T. Duncan Sur. .....Location.

UPSHUR COUNTY

F. A. Fuller et al's No. 1 Penn, 330 ft. from N and E lines of Shell's 80-ac. Penn lease, James Scott Sur. .....Drlg. 2,355 ft.

Virgil Hodges et al's No. 1 J. M. Floyd, 330 ft. from NE cor. of 126-ac. tract, 4 miles N of Gladewater, Railroad Sur. .....Spudding.

Papadake et al's No. 1 L. L. Towery, 1,800 ft. N and 330 ft. E of SW cor. of survey, 5 miles N of Gladewater, W. L. Palmer Sur. .....Derrick.

Randerson et al's No. 1 Nid Minor, 600 ft. from NW line and 1,800 ft. from NE line of tract, D. R. Cannon Sur. .....Rig up.

VAN ZANDT COUNTY

Germany et al's No. 1 C. S. Coker, 150 ft. out of SW cor. of 55-ac. tract, William Daniel Sur. .....Rig up.

Gillum and Allen et al's No. 1 A. T. Bass, 150 ft. from W. line and 150 ft. from N line of 10-ac. tract, William Hart Sur. .....S.D. 3,660 ft.

Griffith Bros.' No. 1 Bruce, 1,000 ft. from S line and 330 ft. from E line of 124-ac. tract, G. Martinez Sur. .....S.D. 1,562 ft.

Humble Oil & Refining Co.'s No. 3 S. R. Ray, 200 ft. N and 160 ft. W of SW cor. of Listenbee 30-ac. tract and on Ray 111.6-ac. tract, Nacogdoches County School Land Sur. .....T.D. 1,257 ft.; showing oil.

Isaac et al's No. 1 C. F. Darrell, 330 ft. from S and W lines of 53-ac. tract, C. B. River Sur. .....Bldg. derrick.

W. E. McKinney et al's No. 2 B. T. Davis, 285 ft. from N line and 235 ft. from W line of 13-ac. tract, J. Goodman Sur. .....S.D. 1,166 ft.

Miller et al's No. 1 J. M. Palmer, 150 ft. from S and E lines of 69-ac. tract, Nacogdoches County School Land Sur. .....S.D. 40 ft.

Peden and Olson's No. 3 W. Banson, 600 ft. S of No. 2 and 140 ft. from W line of tract, J. Goodman Sur. .....Location.

Pure Oil Co.'s No. 2 Ray, 350 ft. N of S line and 183 ft. W of E line of tract, Nacogdoches County School Land Sur, elev. 449.7 ft. .....S.D. 1,215 ft.

Pure Oil Co.'s No. 4 W. F. Swain, 660 ft. E of W line and 200 ft. N of S lines of 33.06-ac. tract, John Walling Sur. .....Derrick.

Pure Oil Co.'s No. 5 O. L. and L. L. Swain, 208 ft. W of E line and 105 ft. N of S line of O. L. and L. L. Swain 48.2-ac. tract, John Walling Sur. .....Drlg. 2,773 ft.

Pure Oil Co.'s No. 9 W. T. Jarman, 1,576 feet N of S line and 250 ft. E of W line of W. T. Jarman 133.8-ac. tract, Nacogdoches School Land Sur. ....Location.

Shell Petroleum Corp.'s No. 12 E. L. Fowler, 224 ft. N of S line and 179 ft. W of E line of 35.35-ac. tract, John Walling Sur. .....Drlg. 1,590 ft.

Wheeler et al's No. 1 Cade, 180 ft. from S line and 150 ft. from E line of 20-ac. tract, Nacogdoches County School Land Sur. .....Rig up.

J. D. Wrather et al's No. 1-A G. W. Carter, 1,000 ft. from S line and 250 ft. from W line of G. W. Carter 171-ac. tract, William Daniel Sur., 4 miles NE of Van .....Location.

WOOD COUNTY

Cauble and Thompson's No. 1-A N. G. Bobbett, 900 ft. from S line and 330 ft. from W line of tract, 2½ miles NW of Mineola, Daniel Fuller Sur. .....Drlg. 4,035 ft.

McElreath and Suggett's No. 1 B. D. Holley, 466 ft. from S and W lines of Holly tract, 3 miles SW of Winnsboro, James M. Moore Sur. .....Location.

Wildcat Operations in West Texas

(Continued from Page 64)

C. J. Davidson et al's No. 1 Cole, 660 ft. from N line and 660 ft. from W line of Sec. 10, Blk. 45, Twp. 1n, T.&P. Sur. .....Drlg. 3,425 ft.; increase in gas at 2,905 ft.

Harrison et al's No. 2 Addis, 990 ft. from N line and 2,200 ft. from W line of Sec. 35, Blk. 43, Twp. 2s, T.&P. Sur. .....S.D. 3,836 ft.

Harrison et al's No. 3 Addis, 1,650 ft. from N line and 2,200 ft. from W line of Sec. 35, Blk. 43, Twp. 2s, T.&P. Sur. .....Location.

Honolulu Oil Co. et al.'s No. 1 Kloh, 660 ft. from E and 1,980 ft. from S of Sec. 33, Blk. 44, Twp. 2s, T.&P. Sur. .....Drlg. 3,800 ft.

Humble Oil & Ref. Co.'s No. 1 Thomas J. Martin, 330 ft. from N and 440 ft. from E line of Sec. 38, Blk. 43, T.&P. Sur. .....Cleaning out; T.D. 4,318 ft.

Humble Oil & Ref. Co.'s No. 2 E. J. Jones, 660 ft. from S line and 1,988 ft. from the W line of Sec. 6, Blk. 44, Twp. 3s, T.&P. Sur. .....Drlg. 3,550 ft.

Landreth Prod. Co.'s No. 1-B T. P. Land Trust, 2,200 ft. from the S line and 440 ft. from the W line of Sec. 3, Blk. 43, Twp. 1s, T.&P. Sur. .....Location.

Landreth Prod. Co.'s No. 2 O. B. Holt, 660 ft. from S and E lines of Sec. 15, Blk. 43, Twp. 1s, T.&P. Sur. .....Cellar.

Landreth Prod. Co. and Llano Oil Co.'s No. 2 O. B. Holt, 1,980 ft. from W and 1,980 ft. from N, Sec. 20, Blk. A, P.S.L. Sur. .....T.D. 4,338 ft.; preparing to test.

Landreth-Llano Oil Co.'s No. 3 Holt, 660 ft. from N line and 660 ft. from W line of Sec. 20, Blk. A, P.S.L. Sur. .....Drlg. 4,280 ft.

Landreth Prod. Co.'s No. 1 Clarence Scharbauer, 660 ft. from S and E lines of Sec. 20, Blk. 44, Twp. 1n., T.&P. Sur. .....Drlg. water well.

Landreth Prod. Co.'s No. 1 O. B. Holt, 1,980 ft. from S line and 660 ft. from E line of Sec. 19, Blk. A, P.S.L. Sur. .....Rig up.

Landreth Prod. Co.'s No. 1 T. P. Land Trust Co., 440 ft. from N line and 2,200 ft. from W line of Sec. 3, Blk. 43, Twp. 1s, T.&P. Sur. .....Drlg. 1,703 ft.

McCurdy et al's No. 1 Foster, 330 ft. from S line and 440 ft. from W line of Sec. 36, Blk. 43, Twp. 2s, T.&P. Sur. .....Drlg. 3,503 ft.

Moran Drlg. Co.'s No. 1 Smith, 330 ft. from N line, 330 ft. from W line of Sec. 12, Blk. 43, Twp. 1s, T.&P. Sur. .....S.D. 4,425 ft.

Stanolind Oil & Gas Co.'s No. 6 J. M. Cowden, 660 ft. from N and 660 ft. W of the SE cor. of Sec. 27, Blk. 43, Twp. 1n, T.&P. Sur. .....Location.

Shell Pet. Corp.'s No. 2 Jones, 660 ft. from S line and 1,980 ft. from E line, Sec. 6, Blk. 44, Twp. 3s, T.&P. Sur. .....Drlg. 1,850 ft.

Skelly Oil Co.'s No. 1 Connell, 1,650 ft. from N line and 440 ft. from E line of Sec. 11, Blk. 16, P.S.L. Sur. .....Rig up.

Stanolind O. & G. Co.'s No. 3 E. F. Cowden, 2,275½ ft. E and 330 ft. from S line, Sec. 36, Blk. 43, Twp. 2s, T.&P. Sur. .....Drlg. 3,994 ft.; showing oil.

Stanolind Oil & Gas Co.'s No. 5 J. M. Cowden, 660 ft. from N and 1,980 ft. from E line of Sec. 34, Blk. 43, Twp. 1n, T.&P. Sur. .....T.D. 4,440 ft.; plugged back to 4,392 ft.; will treat with acid.

Fred Turner, Jr.'s No. 1-C F. V. Addis, 1,650 ft. from the N line and 2,200 ft. from the W line of Sec. 35, Blk. 43, Twp. 2s, T.&P. Sur. .....T.D. 4,000 ft.; will treat with acid.

Fred Turner's No. 2-A Addis, 2,310 ft. from N and 440 ft. from E of Sec. 35, Blk. 43, Twp. 2s, T.&P. Sur. ....Cellar.

FISHER COUNTY

E. T. Campbell et al's No. 1 W. R. Bishop, 570 ft. from S and 150 ft. from E of NW cor. of Sec. 18, Blk. 21, T.&P. Sur. .....Location.

Condor Pet. Co.'s No. 1 Herring, 450 ft. from S and 330 ft. from W line of Sec. 192, Blk. 1, B.B.B.&C. Sur. .....Drlg. 1,605 ft.

Condor Pet. Co.'s No. 2 Wilson, 640 ft. from N and 2,310 ft. from W line of Sec. 6, Blk. R. W. E. Richardson Sur. .....Cellar.

Rosser & Pendleton's No. 2 Frank Steele, 1,470 ft. from S and 990 ft. from W line of Sec. 210, Blk. 1, B.B.B.&C. Sur. .....Drlg. 3,200 ft.

Sinclair Prairie Oil Co.'s No. 3 Frank Steele, 990 ft. from N and 330 ft. from E line of Sec. 73, Blk. 1, H.&T.C. Sur. .....Drlg. 2,900 ft.

Southern's No. 1 King, 660 ft. from N and 330 ft. from W line of SW Sec. 193, B.B.B.&C. Sur. ..... T.D. 3,097 ft.

Stanolind Oil & Gas Co.'s No. 5 Steele, 1,170 ft. from S and 990 ft. from W line of Sec. 210, Blk. 1, B.B.B.&C. Sur. ..... Rig up.

Texas Inland Oil & Gas Co.'s No. 1 First National Bank of Hamlin, 1,980 ft. from N and 990 ft. from W, Sec. 191, Blk. 1, B.B.B.&C. Sur. ..... Running tubing to test. T.D. 3,123 ft.; P.B. to 3,112 ft.

Texas Co.'s No. 4 T. A. Jean, 920 ft. from N and E lines of Sec. 201, Blk. 1, B.B.B.&C. Sur. ..... T.D. 3,114 ft.; will treat with acid.

Texas Co.'s No. 2-B Teagarden, 990 ft. from S and 330 ft. E of NW cor. of S half of Sec. 9, Blk. 8, W. E. Richardson Sur. ..... Location.

Texas Co.'s No. 1 First National Bank of Rotan, 330 ft. N and E of the NW cor. of Sec. 210, B.B.B.&C. Sur. ..... Rig.

GLASSCOCK COUNTY

Steve Currie et al's No. 1 Turner, 330 ft. from N line and 330 ft. from E line of Sec. 19, Blk. 33, Twp. 2s, T.&P. Sur. ..... Location.

Steve Currie et al's No. 1 Underwood, 660 ft. from N line and 660 ft. from E line of Sec. 24, Blk. 3, Twp. 4s, T.&P. Sur. ..... Location.

Empire Gas & Fuel Co.'s No. 3 G. T. Hall, 330 ft. from the N line and 990 ft. from the W line of Sec. 21, Blk. 33, Twp. 2s, T.&P. Sur. ..... Location.

John I. Moore et al's No. 1 J. S. McDowell, 1,980 ft. from N line and 660 ft. from E line of Sec. 32, Blk. 34, Twp. 2s, T.&P. Sur. ..... Drlg. 1,760 ft.

Noble Drlg. Co.'s No. 1 Edwards, 2,310 ft. from W and 330 ft. from S of Sec. 17, Blk. 33, Twp. 2s, T.&P. Sur. ..... T.D. 2,080 ft.

Noble Drlg. Co.'s No. 1 Lee, 330 ft. from N line and 2,310 ft. from E line of Sec. 20, Blk. 33, Twp. 2s, T.&P. Sur. ..... Drlg. 1,215 ft.

Noble Drlg. Co.'s No. 2 W. P. Edwards, 330 ft. from the S line and 330 ft. from the W line of Sec. 17, Blk. 33, Twp. 2s, T.&P. Sur. ..... Location.

Simms Oil Co.'s No. 2 W. P. Edwards, 330 ft. from S and 990 ft. from E of Sec. 18, Blk. 33, Twp. 2s, T.&P. Sur. ..... Location.

Simms Oil Co.'s No. 1 W. P. Edwards, 330 ft. from S and E lines of Sec. 18, Blk. 33, Twp. 2s, T.&P. Sur. ..... Drlg. 1,750 ft.

Tribal Oil Co.'s No. 5 M. M. Edwards, 330 ft. from S line and 990 ft. from the W line of Sec. 16, Blk. 33, Twp. 2s, T.&P. Sur. ..... Location.

HOWARD COUNTY

Humble Oil & Ref. Co.'s No. 3 W. R. Settles, 1,650 ft. from W line and 330 ft. from the S line of Sec. 132, Blk. 29, W.&N.W. Sur. ..... Location.

Continental Oil Co.'s No. 2 Gilbreath, 330 ft. from N line and 660 ft. from E line of Sec. 24, Blk. 33, Twp. 2s, T.&P. Sur. ..... Location.

L. C. Harrison et al's No. 2 Texas Land & Mortgage Co., 2,310 ft. from E line and 330 ft. from the S line of Sec. 4, Blk. 30, Twp. 1s, T.&P. Sur. ..... Location.

Humble Oil & Ref. Co.'s No. 2 Settles, 990 ft. from W and 330 ft. from S, Sec. 132, Blk. 29, W.&N.W. Sur. ... Pumped 520 bbls., 40 per cent water; T.D. 2,428 ft.

Plymouth Oil Co.'s No. 11 Kloh, 1,320 ft. from S line and 660 ft. from W line of Sec. 5, Blk. 32, Twp. 2s, T.&P. Sur. ..... Rig up.

Permian Pacific Pet. Co.'s No. 1 Capps, 330 ft. from SW cor. of Sec. 17, Blk. 29, Twp. 1n, T.&P. Sur. ..... Location.

Plymouth Oil Co.'s No. 10 Kloh, 660 ft. from S line and 660 ft. from W line of Sec. 5, Blk. 32, Twp. 2s, T.&P. Sur. ..... Drlg. 1,625 ft.

Joe Rusk et al's No. 3 G. M. Dodge, 330 ft. from the N line, 330 ft. from the E line, Sec. 9, Blk. 30, Twp. 1s, T.&P. Sur. ..... Rig up.

Shell Pet. Corp.'s No. 4-A Kloh, 990 ft. from S line and 660 ft. from E line of Sec. 13, Blk. 33, Twp. 2s, T.&P. Sur. ..... Drlg. 2,125 ft.

Sinclair Prairie Oil Co.'s No. 1 Perry Jones, 2,310 ft. from W and 330 ft. from N, Sec. 9, Blk. 30, Twp. 1s, T.&P. Sur. ..... Set csg. 2,361 ft.

Sinclair Prairie Oil Co.'s No. 12 Dodge, 330 ft. from S line and 2,360 ft. from W line, Sec. 11, Blk. 30, Twp. 1s, T.&P. Sur. ..... Derrick.

Sloan & Lewis' No. 1 Daniell, 2,475 ft. from E and 330 ft. from S of Sec. 18, Blk. 31, Twp. 1n, T.&P. Sur. ... Drlg. 2,715 ft.

Southern Oil Co.'s No. 1 Denman, 2,310 ft. from N line and 330 ft. from W line of Sec. 10, Blk. 30, Twp. 1s, T.&P. Sur. ..... Cleaning out after shot; T D 2,818 ft.

Southern Oil Co.'s No. 1 Frazier, 660 ft. from S line and 660 ft. from W line of Sec. 4, Blk. 33, Twp. 10s, T.&P. Sur. ..... Location.

IRION COUNTY

Melrose Oil Co.'s No. 1 J. D. Sugg, 1,700 ft. from the E line and 308 ft. from the S line of Sec. 25, Blk. 2, E.&T.C. Sur. ..... Location.

Williams-Short's No. 1 Gentry, 2,200 ft. from N line and 2,080 ft. from W line of Sec. 1, Blk. 3, H.&T.C. Sur. .. S.D. 835 ft.

JONES COUNTY

C. P. Campbell's No. 2 Herndon, 1,450 ft. from S line and 800 ft. from W line, Sec. 6, M.E.P.&P. Sur. ..... Swabbed 5 bbls. of fluid per hour; T.D. 2,497 ft.

Clifton ¾ Brazelton et al's No. 1 Cassey, 200 ft. from N and W lines of SE cor. of Sec. 15, Blk. 15, T.&P. Sur. ..... Drlg 515 ft.

Elmer Close et al's No. 1 A. B. Faulks, 330 ft. from N line and 220 ft. from W line of Subdiv. No. 37, Henry Millard Sur. ..... S.D. 1,400 ft.

Condor Pet. Co.'s No. 2 Sayles, 650 ft. from N line and 960 ft. from W line of Sec. 3, Blk. 30, T.&P. Sur. ... Drlg. 600 ft.

Guthrie & Lancaster's No. 1-B Campbell, 330 ft. from N and 2,276 ft. from E line of Sec. 15, Blk. 19, T.&P. Sur. ..... S.D. 680 ft.

C. C. Julian Rec.'s No. 4 Swan, 2,160 ft. from N line and 1,320 ft. from W line, I. Miley Sur. No. 251 ... Testing; T.D. 2,545 ft.

T. R. Simmons' No. 2 Reynolds, 1,440 ft. from S and 300 ft. from E line of Subdiv. No. 2, A. W. Hill Sur. No. 4 ..... Drlg. 1,715 ft.

Southern Oil Corp.'s No. 2 Williams, 330 ft. from S and W line of Sec. 17, Blk. 19, T.&P. Sur. ..... Rig up.

Texas Inland Oil Co.'s No. 1 J. E. Sellers, 200 ft. from NE of NW cor. of W. Dick Sur. No. 241, Abst. No. 167 ..... 1,050 ft. of oil in hole; T.D. 1,748 ft.

LOVING COUNTY

R. L. Allen's No. 2 fee, 4,290 ft. from NE line, 990 ft. from SE line, Sec. 82, Blk. 33, H.&T.C. Sur. ..... Location.

R. L. Allen's No. 3 fee, 4,290 ft. from NE line, 990 ft. from NW line, Sec. 82, Blk. 33, H.&T.C. Sur. ..... Location.

R. L. Allen's No. 4 fee, 4,290 ft. from NE line, 330 ft. from NW line, Sec. 82, Blk. 33, H.&T.C. Sur. ..... Location.

The California Oil Co.'s No. 8 Reagan-McElvain, 330 ft. from NW and SW lines of Sec. 84, Blk. 1, W.&N.W. Sur. ..... Drlg. 680 ft.

Eppenauer Drlg. Co.'s No. 2 Hammill & Ellis, 410 ft. from NW and 796 ft. from NE lines of Sec. 2, Blk. 1, W.&N.W. Sur. ..... Cellar.

William Little's No. 1 Reichard & Dehle, 1,320 ft. from NE and 1,120 ft. from SE line of Sec. 82, Blk. 1, W.&N.W. Sur. ..... Drlg. 4,200 ft.

H. W. Martin's No. 4 Wheat, Ramsey, 990 ft. from SE and SW lines of Sec. 83, Blk. 1, W.&N.W. Sur. ..... Drlg. 850 ft.

Sinclair Prairie Oil Co.'s No. 2 Bell, 410 ft. from SE and 1,025 ft. from NE of Sec. 91, Blk. 1, W.&N.W. Sur. ..... T.D. 4,267 ft.; swabbing 180 bbls.

J. F. Slack's No. 1 Covey, 2,310 ft. from NE line and 330 ft. from SE line of Sec. 3, Blk. 2, W.&N.W. Sur. .. Spudded and S.D.

PECOS COUNTY

Mack T. Anderson's No. 1 McKenzie, 660 ft. from S line and 660 ft. from W line of Sec. 1, Blk. 604 ..... S.D. 500 ft.

M. D. Bryant et al's No. 1 Reed, 169 ft. from E line and 194 ft. from N line of the N half of the 8-acre tract, Bob Reed Sur. ..... Drlg. 1,115 ft.

Cardinal Oil Co.'s No. 17-E Tippett, 150 ft. from E line of W half and 730 ft. from N of No. 5-E, Sec. 40, Blk. 194, G.C.&S.F. Sur. ..... Waiting on orders; T.D. 481 ft.

Culberson Bros.'s No. 15-B Monroe, 725 ft. from N line and 1,380 ft. from E line of Sec. 39, Blk. 194, G.C.&S.F. Sur. ..... Location.

A. Fasken's No. 1 Reed, 169 ft. from W line and 194 ft. from N line of the N half of the 8-acre tract, Bob Reed Sur. ..... Drlg. 930 ft.

Humble Oil & Ref. Co.'s No. 1 White, Baker, 1,320 ft from N and E lines of Sec. 44, Blk. Z, T.C. Sur. ..... Drlg. 9,415 ft.

Mid-Kansas Oil & Gas Co.'s No. 18 Smith-Taylor, 1,296 ft. from S line, 1,390 ft. from W line, Sec. 33, Blk. 194, G.C.&S.F. Sur. ..... Location.

Mid-Kansas Oil & Gas Co.'s No. 24 Smith-Taylor, 250 ft. W of S half of Turner Tract No. 1, Sec. 33, Blk. 194, G.C.&S.F. Sur. ..... Road.

Mid-Kansas Oil & Gas Co.'s No. 25 Smith-Taylor, 344 ft. W of SE cor. of S half of Turner Trace No. 1, Sec. 33 ..... S.D. 750 ft.

Mid-Kansas Oil & Gas Co.'s No. 26 Smith-Taylor, 396 ft. S and 344 ft. E of SE cor. of S half of Tract No. 1 ..... Cellar.

Mid-Kansas Oil & Gas Co.'s No. 1 Turner, 250 ft. from N line and 250 ft. from W line of Turner Sur. No. 3.. S.D. 590 ft.

Mid-Kansas Oil & Gas Co.'s No. 12-H Yates, 408 ft. S of N line of Sec. 33 and 344 ft. W of SE cor. of S half of Tract No. 1 ..... Location.

Mid-Kansas Oil & Gas Co.'s No. 13-H Yates, 408 ft. S of N line of Sec. 33 and 344 ft. E of SE cor. of S half of Tract No. 1 ..... Location.

Mid-Kansas Oil & Gas Co.'s No. 38-A Yates, 250 ft. E and 305 ft. S from the NE cor. of Turner Tract No. 3 in Sec. 34½, I. G. Yates Sur. ..... Location.

Mid-Kansas Oil & Gas Co.'s No. 39-A Yates, 150 ft. N and 250 ft. W of the NW cor. of Turner tract No. 4, in Sec. 34½, I. G. Yates Sur. ..... Cellar.

Mid-Kansas Oil & Gas Co.'s No. 40-A Yates, 344 ft. from E line and 395 ft. from N of SE cor. of S half of Turner Tract No. 1 ..... S.D. 680 ft.

Mid-Kansas Oil & Gas Co.'s No. 33-B Yates, 1,010 ft. from S line and 500 ft. from W line of Sec. 61, I.&G.N. Sur. ..... Tested 92,300 bbls. per day; T.D. 1,320 ft.

Mid-Kansas Oil & Gas Co.'s No. 34-B Yates, 1,088 ft. from N line and 498 ft. from W line of Sec. 61, I.&G.N. Sur. ..... T.D. 1,202 ft.

Simms Pet. Co.'s No. 2 A. J. Devlin, 330 ft. from the N line and 330 ft. from the E line of the most easterly NE cor. of Sec. 2, John D. Duval Sur., Abst. No. 2,824 ..... Location.

REAGAN COUNTY

E. P. Kirschner and White's No. 1 W. A. White and McIntosh, 720 ft. from E and 800 ft. from N of Sec. 1,223, E.L.R.R. Sur. ..... T.D. 2,765 ft.

REEVES COUNTY

Grisham-Hunter Corp.'s No. 1 fee, 1,320 ft. from N line, 1,320 ft. from the E line of Sec. 10, Blk. 50, Twp. 8, T.&P. Sur. ..... Spudding.

Hugo Freels' No. 1 B. Greenman, 330 ft. from NE line and 231 ft. from SE line of Sec. 21, Blk. 2, H.&G.N. Sur. ..... Shot 220 qts. from 3,778-3,980 ft.; no results; S.D.; T.D. 3,985 ft.

C. H. Lockhart et al's No. 1 W. D. Johnson, 330 ft. from N line and 330 ft. from W line of Sec. 3, Blk. C-13, P.S.L. Sur. ..... Moving in material.

RUNNELS COUNTY

Agnew & Sons' No. 2 Fowler, 1,165 ft. from S and 150 ft. from W of NE cor. of Blk. 23, N. Travis Sur. .... T.D. 2,547 ft.; flowed water.

Agnew and Currie's No. 1 H. E. Wade, 2,640 ft. from N line and 320 ft. from E line of Sec. 24, Domingo Diaz Sur. No. 533 ..... Rigging up.

Anderson et al's No. 1 W. F. James, 330 ft. from N and W lines of Subdiv. No. 20, Norvell Travis Sur. .... Spudded and S.D.

Castor & Anderson et al's No. 1 W. F. James, 174 ft. from W line of Subd. No. 36, Norvell Travis Sur. No. 533 ..... Drlg. 1,106 ft.

L. L. Evans et al's No. 1 L. P. Woods, 330 ft. from SE line and 200 ft. from SW lines of section, T. Williams Sur. No. 529 (old hole being reworked) ..... Cleaning out 2,210 ft.

Golden Pet. Corp.'s No. 3 McMillan, 780 ft. from W and 330 ft. from N of Subdiv. No. 32, N. Travis Sur. No. 533 ..... Flowed 130 bbls. in 24 hrs.; T.D. 2,528 ft.

Melrose Oil Co.'s No. 1 L. P. Woods, 150 ft. from NE lines and 3,475 ft. from W line of survey, Willett Holmes Sur. No. 100 ..... Drlg. 1,201 ft.

Roberts Oil Corp.'s No. 1 J. L. King, 660 ft. from N line and 470 ft. from W line of most northerly King tract (old well being drilled deeper) ..... Cleaning out; T.D. 3,560 ft.

W. S. Sawyer et al's No. 1 Giesecke, 1,311 ft. from N and 4,606 ft. from E lines of survey, Blk. 131, James Hughes Sur. ..... Drlg. 1,927 ft.; no report.

Prairie Oil & Gas Co.'s No. 1 T. E. Wade, 2,597 ft. from N and 2,146 ft. from E line of Subdiv. No. 16, Norvel Travis Sur. ..... Drlg. 2,165 ft.

R. Tucker et al's No. 5 McMillan, 350 ft. from N and W lines of that part of Subd. No. 32 in the D. Diaz Sur. ..... Drlg. 435 ft.

F. D. Williams' No. 1 J. L. Elkins, 2,225 ft. from E and 1,300 ft. N of SW cor. of Blk. 13, but in Blk. 13, N. Travis Sur. No. 533 ..... S.D. 1,500 ft.

SCHLEICHER COUNTY

John M. Cooper et al's No. 1 Bert Page, 1,290 ft. from N line, 1,470 ft. from W line of Sec. 40, Blk. L, G.H.&S.A. Sur. (old well being drilled deeper) ..... Preparing to start up.

SCURRY COUNTY

Coffield & Guthrie's No. 1 Bryce, 330 ft. from S and W lines of Sec. 133, Blk. 97, H.&T.C. Sur. (old well being drilled deeper) ..... O.T.D. 1,905 ft.

TERRELL COUNTY

H. H. Sides' No. 1 Phelps, 2,157 ft. from N line and 2,483 ft. from the W line of Sec. 5, Blk. 4-A, G. W. Turley Sur. ..... S.D. 5,635 ft.

UPTON COUNTY

Powell-Gap Oil Co.'s No. 1 J. F. Lane, 1,320 ft. from W line of Sec. 1, G.C.&S.F. Sur. ..... T.D. 2,175 ft.; pumped 115 bbls. per day.

Gulf Prod. Co.'s No. 103 McElroy, 1,980 ft. from S and 660 ft. from W, Sec. 197, Blk. F, C.C.S.D.&R.G.N.G. Sur. ..... Drlg. 10,181 ft.

Texas Pacific Coal & Oil Co.'s No. 1-C J. H. Sherk, 1,650 ft. from S and 330 ft. from W, Sec. 1, Blk. 3-B, M.K.&T. Sur. ..... Testing; T.D. 2,631 ft.

Texas Pacific Coal & Oil Co. and Humble Oil & Ref. Co.'s No. 13 J. H. Shirk, 990 ft. from the S line and 330 ft. from the E line of Sec. 1, Blk. 3, M.K.&T. Sur. ..... Drlg. 745 ft.

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THE RESULTS: Oil No. 4 quit at 1,713.2 miles—Oil No. 6 at 1,764.4 miles—Oil No. 5 at 1,815.9—Oil No. 1 at 2,266.8—Oil No. 3 at 3,318.8. Oil No. 2, New and Improved Conoco Germ Processed Motor Oil, carried on to 4,729 miles!

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New York City
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Richmond, Virginia
Salt Lake City, Utah

Texas Pacific Coal & Oil Co.'s No. 3-B Lane, 330 ft. from E and 990 ft. from S of Sec. 1, Blk. 3, M.K.&T. Sur. ..... Moving in material.
Theabotal Oil Co.'s No. 2 J. F. Lane, 1,650 ft. from N and 990 ft. from E of Sec. 36, Blk. 1, M.K.&T. Sur. ..... S.D. 250 ft.
Williams & Williams Drlg. Co.'s No. 1 Robbins, 1,600 ft. from S and 1,900 ft. from E, Sec. 4, G.C.&S.F. Sur.... Drlg. 2,037 ft.

VAL VERDE COUNTY

South-Western Exploration Co.'s No. 1 E. K. Fawcett, 1,310 ft. from S and 2,310 ft. from E, Sec. 14, Blk. L, G.C.&S.F. Sur. ..... Rig up.

WARD COUNTY

Alexander's No. 1 Richter, 1,650 ft. from NW, 1,170 ft. from NE line of Sec. 37, Blk. 33, H.&T.C. Sur. ..... S.D. 1,460 ft.
Atlantic Oil & Prod. Co.'s No. 16 W. D. Johnson, 320 ft. from NE and 330 ft. from NW lines of Sec. 9, Blk. 34, H.&T.C. Sur. ..... Flowed 256 bbls. in 24 hrs.; T.D. 2,531 ft.
Atlantic Oil & Prod. Co.'s No. 17 Johnson, 1,650 ft. from NE line and 1,650 ft. from SE line of Sec. 9, Blk. 34, H.&T.C. Sur. ..... Rig up.
Atlantic Oil & Prod. Co.'s No. 18 W. D. Johnson, 1,650 ft. from the NE line of Sec. 9, Blk. 34, H.&T.C. Sur. Location.
L. G. Bradstreet et al's No. 1 Lee Monroe, 2,310 ft. from NE and 330 ft. from SE lines of Sec. 77, Blk. 34, H.&T.C. Sur. ..... S.D. 1,037 ft.
California Oil Co.'s No. 6 York, 1,650 ft. from S and 990 ft. from SW, Sec. 10, Blk. 34, H.&T.C. Sur. ..... Drlg. 2,526 ft.
California Oil Co.'s No. 2 Durgin, 330 ft. from SW and 330 ft. from SE of Sec. 15, Blk. 34, H.&T.C. Sur. ..... Drlg. 2,444 ft.
California Oil Co.'s No. 7 York, 1,650 ft. from SW line and 2,310 ft. from SE line of Sec. 10, Blk. 34, H.&T.C. Sur. ..... Drlg. 2,507 ft.
C. C. Duffey et al's No. 1 Llano-Sloan, 1,650 ft. from NW and NE lines of Sec. 24, H.&T.C. Sur. ..... Drlg. 805 ft.
Gulf Prod. Co.'s No. 28 Hutchins, 2,310 ft. from S line and 330 ft. from W line of Sec. 4, Blk. F, G.M.M. B.&A. Sur. ..... Drlg. 1,980 ft.
Gulf Prod. Co.'s No. 27 Hutchins, 2,310 ft. from N line and 330 ft. from W line of Sec. 4, Blk. F, G.M.M.B.&A. Sur. ..... Set csg. 2,549 ft.
Gulf Prod. Co.'s No. 43 O'Brien, 2,310 ft. from N line and 990 ft. from W line, Sec. 17, Blk. F, G.M.M. B.&A. Sur. ..... Drlg. 2,740 ft.
Gulf Prod. Co.'s No. 44 O'Brien, 2,310 ft. from N line, 330 ft. from W line of Sec. 17, Blk. F, G.M.M.B.&A. Sur. ..... S.D. for repairs; T.D. 2,552 ft.
Gulf Prod. Co.'s No. 45 O'Brien, 1,650 ft. from S line and 330 ft. from E line of Sec. 17, Blk. F, G.M.M. B.&A. Sur. ..... Drlg. 1,850 ft.
Gulf Prod. Co.'s No. 46 O'Brien, 1,650 ft. from S line and 990 ft. from E line of Sec. 17, Blk. F, G.M.M. B.&A. Sur. ..... Drlg. 1,250 ft.
Humble Oil & Ref. Co.'s No. 2 Louis Richter, 1,650 ft. from the NW line and 1,470 ft. from the SW line of Sec. 23, Blk. 34, H.&T.C. Sur. ..... Tested 600 ft. of oil and 30 ft. of S.W.; T.D. 2,550 ft.
Humble Oil & Ref. Co.'s No. 3 Richter, 2,316 ft. from NE line and 1,698 ft. from SE line of Sec. 27, Blk. 34, H.&T.C. Sur. ..... Testing; T.D. 2,550 ft.
Jack Leidecker et al's No. 1 Shell-Sloan, 990 ft. from NE and 330 ft. from NW of Sec. 15, Blk. 5, H.&T.C. Sur. ..... T.D. 2,700 ft.
Rector Oil Co.'s No. 1 Lee Monroe, 660 ft. from NE and 660 ft. from SE of Sec. 62, Blk. 33, H.&T.C. Sur... S.D. 4,661 ft.
Richardson's No. 1 Johnson, 330 ft. from NE line and 2,310 ft. from NW line of Sec. 22, Blk. 34, H.&T.C. Sur. ..... Location.
Sinclair Prairie Oil Co.'s No. 5 Archenhold, 2,310 ft. from SE and 2,310 ft. from SW of Sec. 23, Blk. 5, H.&T.C. Sur. ..... T.D. 865 ft.
Tex-Mex Pet. Corp.'s No.2-D Shell-Sloan, 2,310 ft. from NE and 990 ft. from NW, Sec. 16, Blk. 5, H.&T.C. Sur. ..... Cellar.
Tex-Mex Pet. Corp. et al's No. 2 Cal-Archenhold, 990 ft. from NE and 330 ft. from SE, Sec. 23, Blk. 5, H.&T.C. Sur. ..... Flowed 25 bbls. per day; T.D. 2,634 ft.
Tex-Mex Oil Co.'s No. 3-B Shell-Sloan, 1,650 ft. from NE and 330 ft. from NW lines of Sec. 16, Blk. 5, H.&T.C. Sur. ..... Drlg. 2,325 ft.
Westex Oil Co.'s No. 1 Cynthia Monroe et al, 330 ft. from SE and 330 ft. from SW lines of NE 80 acres of Sec. 2, J. V. Borders Sur. ..... Drlg. 450 ft.

WINKLER COUNTY

Colonial Oil Co.'s No. 4 Amerada-Scarborough 990 ft. from N line and 990 ft. from E line of Sec. 18, Blk. 74, P.S.L. Sur. ..... Drlg. 2,780 ft.
Magnolia Petroleum Co.'s No. 2 Walton, 330 ft. from N and 330 ft. from E, Sec. 19, Blk. 74, P.S.L. Sur. ..... T.D. 2,571 ft.; set csg.
Magnolia Pet. Co.'s No. 5 Scarborough, 1,650 ft. from N line and 370 ft. from E line of Sec. 18, Blk. 74, P.S.L. Sur. ..... Set csg.; T.D. 1,230 ft.
McCurdy & Easter's No. 1 Scarborough, 1,650 ft. from W and 2,310 ft. from S, Sec. 1, Blk. 77, P.S.L. Sur.... Rigging up and S.D.
Sid Richardson's No. 2-B Scarborough, 2,310 ft. from E line and 990 ft. from S line of Sec. 18, Blk. 74, P.S.L. Sur. ..... Testing; flowed 86 bbls.
Sid Richardson's No. 5-A Scarborough, 330 ft. from W and 190 ft. from S, Sec. 1, Blk. 22-C, P.S.L. Sur. ..... Moving in machine.
Richardson et al's No. 3 Scarborough, 150 ft. from S line and 2,310 ft. from W line of Sec. 1, Blk. C-22, P.S.L. Sur. ..... Drlg. 2,175 ft.
Richardson's No. 4 Scarborough, 330 ft. from N line and 2,310 ft. from W line of Sec. 1, Blk. 77, P.S.L. Sur... Drlg. 685 ft.
Richardson's No. 5 Scarborough, 150 ft. from S line and 1,740 ft. from W line of Sec. 1, Blk. C-22, P.S.L. Sur. ..... Material.
Richardson's No. 6 Scarborough, 330 ft. from N line and 2,310 ft. from W line, Sec. 18, Blk. 174, P.S.L. Sur. .. Location.
Sinclair Prairie Oil Co.'s No. 1-C Scarborough, 2,310 ft. from W and 102½ ft. S of SE cor. Sec. 1, Blk. 22-C, P.S.L. Sur. ..... Flowing 40 to 50 bbls. per day; T.D. 3,035 ft.
Sinclair Prairie Oil Co.'s No. 2-C State-Scarborough, 102 ft. N and 1,650 ft. W of NE cor. of Sec. 1, Blk. 77, P.S.L. Sur. ..... Drlg. 2,385 ft.
Tide Water Oil Co.'s No. 2 Scarborough, 105 ft. from S line and 990 ft. from E line of Sec. 1, Blk. C-22, P.S.L. Sur. ..... Drlg. 2,806 ft.

Wildcat Operations in Southwest Texas

(Continued from Page 162)

S. E. Gantt's No. 1 A. B. Stephen, 2,650 ft. from SW line, 740 ft. from SE line of P. W. Hays Sur. .... Drlg. 452 ft.
Thos. Gorton's No. 1 Edward Jackel, 600 ft. from N line, 300 ft. from E line of tract in J. Ward Sur. .. T.D. 500 ft.; S.D.
George L. O'Neill's No. 1 Neimann in Juan Montez Sur. No. 6 ..... T.D. 1,425 ft.; S.D.
J. W. Johnson's No. 1 Willow Springs, 150 ft. from N and W lines of lease in B. Munos Sur. No. 151..... T.D. 1,940 ft.; S.D.; made salt wtr. and some oil.
Fred A. Perrenot's No. 1 Russell, 750 varas from NE line, 54 varas from NW line of 640-ac. tract in Rodrigues Sur. ..... T.D. 1,315 ft.; standing.

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TULSA, OKLAHOMA—MAY 12-19

H. H. Price's No. 1 Barragan, 150 ft. from S and E lines of 40-ac. tract ..... T.D. 419 ft.; S.D.; to be comp. by H. E. Lewis.

N. S. Powell's No. 1 M. Sanner, 400 ft. from E line, 5,280 ft. from N line of 128-ac. tract in Ruiz Sur. No. 47 ..... T.D. 780 ft.; S.D.

C. A. Smith's No. 1 Henry Lamb, 750 ft. from N and E lines of Lamb farm, in de la Garza grant ..... T.D. 982 ft.; show of oil and gas from 965-82 ft.; reaming to set csg.

A. A. Wietzel's No. 1 fee, F. Ricardo Sur. ..... Drlg. lime 1,695 ft.
Trawalter Oil Co.'s No. 2 fee, Jett Sur. ..... Drlg. lime 1,116 ft.; 1,108-15 ft. sandy shale; show of heavy black oil.

BLANCO COUNTY

Rogers et al's (formerly Pedernales Pet. Corp.) No. 1 Lester, 550 ft. from N line, 6,100 ft. from W line of Antonio Bendrand Sur. ..... T.D. 1,215 ft.; (no report).

BURLESON COUNTY

Brush & Hays' No. 1 C. W. Young, 150 ft. from SW line and 750 ft. from SE line of 140-ac. tract in Bird Sur. (7 mi. SE of Caldwell) ..... T.D. 309 ft.; S.D.

CALDWELL COUNTY

S. S. Cargill's No. 2 Dameron, 150 ft. from W line, 450 ft. from N line of D. Cooper Sur. ..... T.D. 2,261 ft.; top Edwards 2,-260 ft.; show oil; setting csg.

F. H. Etheridge et al's No. 1 Perry, 300 ft. from SE line and 300 ft. from NE line of 27-ac. lease in P. Martinez Sur. (N of Lytton Springs) ..... Rigging up and S.D.
Hinton & Dodson's No. 1 Carrie Lipscomb, 150 ft. from S line of 56.6-ac. tract and 150 ft. from E line (road) on N end of old Luling Field in Guadalupe Co. Sur. ..... Drlg. 1,700 ft.; 10-in. at 41 ft.
Wilford Kean et al's No. 1 Wm. Ewalk, 150 ft. from E line and 150 ft. from N line of 126-ac. tract, or 3,650 ft. from N and 1,800 ft. from E lines of Jas. George Sur. (3½ mi. from Lockhart) ..... Shale 1,562 ft.; S.D.
J. Edward Mills et al's No. 1 Emma Johnson, 1,650 ft. from N line and 4,350 ft. from W line of Jas. Pinch-back Sur. (6 mi. SE of Lockhart) ..... Sand 2,111 ft.; slight show oil; S.D.

H. J. Porter's No. 1 A. Carter, 1,938 ft. from NE line and midway between NW and SE lines of 32-acre farm in G. Pace Sur. (NE of Lytton Springs) ..... Drlg. shale 1,445 ft.
Webster Oil & Gas Co.'s No. 1 Robinson, 770 ft. S and E from NW cor. of 100-ac. tract in John A. Neill Sur.. S.D. 2,390 ft.

CALHOUN COUNTY

Continental Oil Co.'s No. 1 American Natl. Realty Co., center of NE of Sec. 6, Blk. C, Calhoun Cattle Co., Subd. of Port O'Connor pasture (9 mi. SE of Seadrift) ..... Location for 8,000-ft. test.
Heep Oil Corp.'s No. 1 P. Welder, J. M. Rice Sur. ..... T.D. 5,142 ft.; reaming.
Heep Oil Corp.'s No. 2 P. Welder, Day Land & Cattle Co., A-238, center of Sur., 2¾ mi. W of SW of McKinney, 650 ft. NW line and 3,950 ft. SW line of Sur. (4 mi. W of Clark) ..... T.D. 915; W.O.C.

COMAL COUNTY

Keystone Royalties' No. 1 L. T. Burns, 1,000 ft. from N and W lines of 265-ac. tract in McNutt Sur., Blk. 32 ..... Moving in.

DUVAL COUNTY

Cecil Best's No. 1 Parr, 1,320 ft. from SE line and 990 ft. from NE line of Sur. 124 (10 miles W and 2 miles N of San Diego) ..... Drlg. 3,034 ft.
Bridwell Oil Co.'s No. 1 Wood Welder, 4,950 ft. from N line and 330 ft. from W line of Sur. 102 ..... T.D. 2,364 ft.; abnd.
Buffalo-Texas Drlg. Synd., Inc.'s No. 1 Escobar, 700 varas from W line, 1,000 varas from N line of 930-ac. tract in Francisco grant ..... T.D. 2,324 ft.; S.D.; two D.S. tests failed.
Chiquita Oil Co.'s No. 1 Richardson, 330 ft. from N and E lines of Sec. 5 ..... T.D. 1,749 ft.; fishing drill stem
Continental Oil Co.'s No. 1 R. Driscoll Est., 180 ft. from S, 1,370 ft. from E lines of lease, Sec. 448 .. T.D. 2,448 ft.; 27 bbls. 14 hrs. with 12,000,000 ft. gas; T.P. 300 lbs.; C.P. 825 lbs.
Continental Oil Co.'s No. 2-A Clara, Driscoll Sevier, 3,675 ft. S and 1,000 ft. from E line of Sec. 448 ..... Location.
Jones & Carragy's No. 1 J. W. Kidd, 330 ft. from S line and 330 ft. from E line of E 40-ac. of SE of Sur. 56 ..... Sand 2,204-13 ft.; preparing to complete.
W. C. McBride's No. 1 Hagist, 330 from N and E lines of SE 80 ac. of Sec. 1 ..... Location.
Sun Oil Co.'s No. 1 Moreno, 330 ft. from E line and 2,000 ft. from S line of NW cor. of H.&W. Sur. 537, in Sec. 540 (5 mi. S of San Diego) ..... Location.
Windsor Oil Co.'s No. 1 B. Peters, 100 ft. from S and 2,309 ft. from E lines of Sur. 34 ..... T.D. 2,628 ft.; D.S. test 2,608-28 ft.; built up 400 lbs. pressure, 6 min.; setting csg.; comp. 30,-000,000 ft. gas; 900 lbs. R.P.
Witherspoon et al's No. 1, Richardson Sur. No. 5 ..... T.D. 1,005 ft.; S.D.
Louis Yeager's No. 1 Yeager, 694 ft. from W line, 1,527 ft. from S line of Sur. No. 38 ..... T.D. 865 ft.; testing.

EDWARDS COUNTY

Love and Evans' No. 1 Steve Brown, 660 ft. from N and E lines of Sec. 66, G.W.T.&P.R.R. Sur., 15 miles W of Rock Springs ..... S.D. 3,002 ft.

FAYETTE COUNTY

Berry-Hay's No. 1 Otto Steinhauser, 1,250 ft. from W line and 330 ft. from N line of John Schroeder Sur. (4 mi. SW of Muldoon) ..... Location.

FRIO COUNTY

Amerada Pet. Co.'s No. 2 Halff & Oppenheimer, begin. at most easterly N cor. of John H. Gibson Sur. No. 16, thence SE along NE line of Sur. 2,100 ft., thence SW at right angles 300 ft. (4 mi. SW of Pearsall) .. Rigging up.

GILLESPIE COUNTY

Dorre et al's No. 3 Lindig ..... Drlg. 137 ft.
Powers et al's No. 2 Lindig, 12,700 ft. from S line, 1,333 ft. from W line of Maria Josephine Guerrera Sur. ..... Location.

GOLIAD COUNTY

H. H. Weinert's No. 1 Grady Smith, 330 ft. from NW line and 330 ft. from SW line of 142-ac. tract in B. & B. Sur. No. 25 (N part of county) ..... (No report) 1,562 ft.

GUADALUPE COUNTY

J. E. Clark's No. 1 M. T. Howell, 9,050 ft. from N line of Howell tract and 1,588 ft. S of highway and 200 ft. from W line of 200-ac. tract of Darst Sur. No. 19 ..... Rigging up.
M. W. Eiser's No. 2 Wells, 1,700 ft. from S line, 200 ft. from W line of Blk. 3, Subd. 1, J. de la Baume Sur. ..... Location.
Holderfield et al's No. 1 Reed ..... Spudding.
Adolph Seideman's No. 1 Seideman, 330 ft. from NE line, 470 ft. from NW line of Mrs. Adolph Seideman 147.5-ac. tract (Subd. 110) in Antonio Maria Esnaurrizar Sur. No. 11 ..... Drlg. 2,692 ft.
L. R. Trout's No. 1 McKee, Green DeWitt Sur. ..... Location abnd.

HAYS COUNTY

J. C. Crowder's No. 1 Burnett, 2,370 ft. from E line, 1,490 ft. from N line of tract in J. Ingram Sur ... T.D. 430 ft.; set csg.; S.D.

HIDALGO COUNTY

D. D. Oil Co.'s No. 1 Mrs. L. George, 330 ft. from N and W lines of 40-ac. tract in Share 12, Porcion 41. Location.
Davis & Harrison's No. 1 Lula George, 300 ft. from S and 700 ft. from E lines of Tract 13, Porcion 41, Ancient Jurisdiction of Reynosa ..... Spudding.
Otto Woods' No. 1 John Lawrence, 530 ft. from W, 300 ft. from N line of Tract 274, Porcion 39, Ancient Jurisdiction of Reynosa ..... Spudding.

Union Sulphur Co.'s No. 1 American Rio Grande L. & I. Co., 400 ft. S and W of NE cor. of Lot 229, Blk. 59 (¼ mi. N of Mercedes) ..... Drlg. 4,185 ft.

JIM HOGG COUNTY

Houston Oil Co.'s No. 5 Cartwright, 1,150 ft. from SW line and 1,775 ft. from SE line of J. M. Colchado Sur. ..... Location.

JIM WELLS COUNTY

Magnolia Pet. Co.'s No. 3 Seeligson, 330 ft. from S line and 1,320 ft. W of No. 2 in V. Canales Sur. No. 218.. Drlg. 2,760 ft.
Plymouth Oil Co.'s No. 1 Cuero Cattle Co., 330 ft. from S and W lines of H.T.&B. Sur. No. 7, 2½ miles W from Alfred ..... Rigging up.
Putnam and Bode's No. 1 McCarley, 600 ft. from SE line and 1,500 ft. from NE line of 300-ac. tract, Blk. A, of W. H. Bode Subdivision of Wallace D. Wade Ranch ..... T.D. 2,325 ft.; show gas 1,745 ft.
C. H. Robertson's No. 1 C. Mull, 330 ft. N of N end of division line between Lots 4-A and 5-A of Seefelds farm lots, or 1,900 ft. from W line, 300 ft. from N line of Pointevant Sur. No. 205 ..... T.D. 3,509 ft.; S.D.

KARNES COUNTY

Magnolia Pet. Co.'s No. 2 Guy Porter, 1,130 ft. from W line and 330 ft. from E line of Brooks & Burleson Sur. ..... Coring sand 3,639 ft.
George Ray's No. 1 Radford, 666 ft. from SW and 3,422 ft. from SE lines of 753-ac. tract in Nichols Sur. (4 miles NE of North Pettus Field) ..... (No report); top Jackson sand 2,-370 ft.
C. J. Webster's No. 1 J. B. Cannon, 1,140 ft. from N line, 250 ft. from E line of 80-ac. tract in Lambrano Sur. ..... T.D. 1,790 ft.; standing; may deepen to Yegua.

KENDALL COUNTY

Martin's No. 1 Houston, Thomas Leople Sur. No. 761 .... Top black shale 1,028 ft.; T.D. 1,985 ft.; to deepen.
A. P. Pierce's No. 1 Werner, in SW cor. of 40-ac. tract, 150 ft. from S and W lines of J. F. Torrey Sur. .... T.D. 992 ft.; standing.

KERR COUNTY

Edminston & Walker's No. 1 Whitworth, 1,160 ft. from S line and 1,333 ft. from E line of Sec. 1,439 of the H.E.&W.T. Sur. ..... Preparing to spud.
Jeff Love and Eastland Oil Co.'s No. 5-E Jeff Love, 1,500 ft. SE of No. 1 and 1,580 ft. from SE cor. and 300 ft. from N line of Sec. 1,591 ..... Location.
G. F. Schreiner's No. 3 Love, 1,420 ft. from W line, 1,260 ft. from S line of Sur. No. 1,594 ..... Location.
Van Duyn & Moore's No. 1 Nowlin, 2,000 ft. from E line, 2,200 ft. from N line of Jas. R. Bettner Sur. No. 99 ..... T.D. 1,040 ft.; standing.

KLEBERG COUNTY

J. S. Brown's No. 1 Antone Dietz, Sec. 7, Hotch estate .. T.D. 2,845 ft.; S.D.
Harry Clark's No. 1 V. J. Kivlin, 360 ft. from E line, 400 ft. from S line of Sec. 39, Blk. 3, Kleberg Town & Improvement Co. Sur. ..... T.D. 2,350 ft.; D.S. test 2,315-19 ft.; four joints mud, oil and sand; S.D.

LASALLE COUNTY

G. O. Ball's No. 1 J. M. Martin, 330 ft. from S and W lines of Martin 485.6-ac. tract, Sur. 683 ..... Moving in.

LEE COUNTY

Jas. B. Pederson's No. 1 Turner, David Hudson Sur. .... Rigging up and S.D.
H. A. Sherlack's No. 1 Otto, 736 ft. from NW line, 1,310 ft. from NE line of 57.5-ac. tract in Thomas Morrow Sur. ..... Drlg. 1,250 ft.

LIVE OAK COUNTY

Holmes & Goodwin's No. 1 fee, 1,000 ft. from N line and 330 ft. from W line of 326-ac. tract in Brigada Haughty Sur. ..... Rigging up.
Witherspoon Oil Co.'s No. 2 H. Clements, 100 ft. S of No. 1 junked hole, Eliz. Jordan Sur. ..... Spudding.
Ike Taylor's No. 2 Griffith, 1,200 ft. from E line and 1,151 ft. from S line of lease in Tract 5, D. Osborne Sur. ..... Rigging up.

MAVERICK COUNTY

Scott Townsend et al's No. 1 Bandera County School Lands, 450 ft. from S line and 651 ft. from W line of Sur. 231 (22 mi. NE of Eagle Pass) ..... T.D. 610 ft.; abnd.
Ollie Wright's No. 1 L. Little, 500 ft. from N line, 3,800 ft. from E line of Potter Sur. No. 65 (10 mi. N of Eagle Pass) ..... T.D. 602 ft.; S.D.

McMULLEN COUNTY

Bedwell's No. 1 Brown, Sur. No. 54 ..... T.D. 771 ft.; S.D.
Al Buchanan's No. 1 Hagist, 990 ft. from E and 330 ft. from N lines of N half of NE Sec. 18 ..... Derrick.
Cotulla's No. 1 Gordon, 330 ft. from N and W lines of S½ of Sec. 127 ..... Drlg. 1,840 ft.
Gleason et al's No. 1 Miles, Chas. Stephens Sur. ..... Location.
Henshaw Bros.' No. 1 Lachusa, 2,800 ft. from N and E lines of Sur. No. 478 ..... T.D. 1,440 ft.; S.D.
Lefevre & Spice's No. 2 Hagist, 2,034 ft. due W of the Lefevre & Spice No. 1 Hagist, Sec. 17 ..... Moving in.
Loma Oil Co.'s No. 1-A Jacob, start at SW cor. of Sur. No. 7, go S 4,963 ft., thence W 330 ft. in Sur. No. 516 ..... Location.
W. C. McBride Co.'s No. 1 Hagist, 330 ft. out of the NE cor. of S half of SE Sec. 1 (½ mi. E of Trinity Drillers' No. 1 Hagist dry hole) ..... Location.
C. C. Schumway, Inc.'s No. 5 Shiner, 330 ft. from N and W lines of NE of Sec. 66 of Schumway Subd. of Shiner Ranch ..... Spudding.
Texlo Oil Co.'s No. 1 Two Rivers Ranch Co., 330 ft. from N line and 330 ft. from E line of Sec. 81 ..... Drlg. 1,480 ft.
Ike Taylor's No. 1 Wolfe, 330 ft. from N line and 330 ft. from E line of Sec. 81 ..... T.D. 1,558 ft.; abnd.

MEDINA COUNTY

Sanders & Scoggins' No. 1 L. W. Burrell ..... Drlg. lime 739 ft.

MILAM COUNTY

O. H. Birdwell's No. 1 J. R. Bartek, 150 ft. from N line, 180 ft. from W line of 88-ac. tract in J. A. de Pena Sur. ..... T.D. 1,559 ft.; show of oil est. ½ bbl. per day.

NUECES COUNTY

Diadem Oil Co.'s No. 1 J. C. Mayo, 1,000 ft. along line from SE cor. in NW direction, thence due N 300 ft. (near Robstown), Sec. 23 ..... Sandy shale 2,341 ft. (no report).
Nueo Oil Co.'s No. 1 Synthia Bluntzer, Herrera Sur., 2,340 ft. from S line, 330 ft. from W line of 639.27-ac. tract ..... Drlg. 2,259 ft.
Sullivan and Texon Royalty Co.'s No. 1 Simmons & Perry, 330 ft. from S and W lines of NE of square 640-ac. section out of SW cor. of Simmons & Perry tract, 3 miles east of Agua Dulce Field ..... T.D. 4,228 ft.; drlg. whipstocked hole 4,145 ft.
United Prod. Co.'s No. 2 Tolbert, 1,250 ft. from S line and 120 ft. from W line of Blk. 9, Sec. 4, Puenticitas grant ..... Drlg. 3,068 ft.

REAL COUNTY

H. J. Heartwell et al's No. 2 L. J. Haby, 694 ft. from W line and 2,153 ft. from S line of A.B.&M. Sur. No. 175 ..... U.R. to reset csg.; T.D. 1,210 ft.

SAN PATRICIO COUNTY

Atkins & O'Neil's No. 1 Welder, 7,398 ft. from E and 317 ft. from S lines of Juan Hart & Sons and John Lucas Sur. (3 miles W of Angelita) ..... T.D. 5,382 ft.; making 175 bbls. per day, one-quarter inch choke; T.P. 500 lbs.; C.P. 1,275 lbs.
Bunte et al's No. 1 C. C. Smith, start at NE cor. of F. Miller tract, go E 2,338 ft., thence S at right angles 819 ft., A. Armstrong Sur. (3 mi. SW of Odom) ..... Location.

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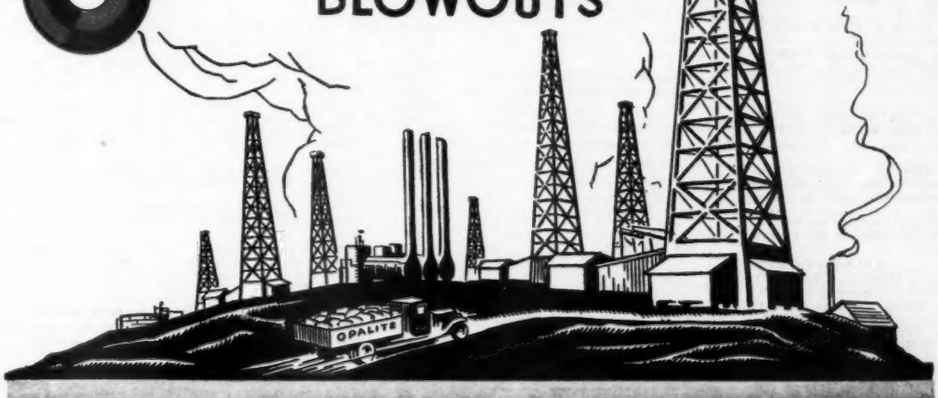

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Carpenter et al's No. 1 Sadler, 300 ft. each way out of SE cor. Blk. 1, Sec. 33, T. Peres Sur. ..... T.D. 603 ft.; W.O.C.
DeLange et al's No. 1 Sevier, 150 ft. N of S line, 7,650 ft. E of most southerly W line of Clara Driskol, Sevier, 7,045-ac. tract in Antonio Ramines Sur., N of Premont area ..... S.D. 1,450 ft.
Diadem Oil Co.'s No. 1 J. C. Mayo, 300 ft. from S and 1,000 ft. from E line of Sec. 23, George H. Powell Subd. of the Driscoll ranch (5 of Robstown) ..... Location.
Plymouth Oil Co.'s No. 1 Welder, 4,700 ft. N of Chiltipin Creek, 900 ft. from W line of J. M. and F. Portilla Sur., 1¼ miles N from Sinton ..... T.D. 6,602 ft.; P.B. 5,200 ft.; D.S. test 5,415-18 ft.; showed 150 ft. fresh wtr., mud and oil; 800 lbs. pres.; running csg.

STARR COUNTY

Chas. H. Andrews et al's No. 1 A. Guerra, San Jose grant, 330 ft. from N and 150 ft. from E line of Sec. 6 (NE part of county) ..... T.D. 310 ft.; S.D.
B. & B. Oil Co.'s No. 2 Kelsey Bass, 330 ft. from W and S lines of Blk. 12 of Subd. of Porcions 86 and 87, jurisdiction Camargo ..... Rigged up and S.D.
Cooper & Andrews' No. 1 J. M. Martinez, SW cor. of Sec. 135 ..... Old well, to deepen; T.D. 3,200 ft.
Dean Bros.' No. 1 M. M. Garcia, 2,150 ft. from S line, 4,600 ft. from W line of Sur. No. 916 ..... Set surface csg.; W.O.C.
Goodwin-Yantis' No. 5 Anna K. Bass, 150 ft. from S and E lines of Blk. No. 10, Sur. No. 3, Porcion 87 ..... Gas sand 685 ft.; running csg.
Goodwin-Yantis' No. 4-A Kelsey Bass, 1,300 ft. NW of No. 3 in Porcions 86 and 87, Ancient Jurisdiction of Camargo ..... T. D. 625 ft.; S.D.
Great Plains Oil Co.'s No. 1 Sanchez, 660 ft. from W line, 330 ft. from S line of SE NW of Sur. No. 344 ..... T.D. 3,524 ft.; S.D.
W. H. Liber's No. 1 I. Y. Garcia, 1,646 ft. from N line, 963 ft. from W line of 254-ac. tract in Porcion No. 76, jurisdiction of Camargo ..... T.D. 1,508 ft.; dry and abnd.
McDonald & Campbell's No. 1 C. C. Bowman, 330 ft. from N and W lines of Blk. 13 ..... Spud and S.D.
McDonald's No. 1 E. A. Pfley, 2,600 ft. from S and W lines of Sur. 933 ..... S.D. 1,630 ft.
Myers, Sullivan & Jenkins' No. 1 Starr County Cattle Co., 330 ft. from N line, 330 ft. from W line, Blk. 62, Porcion 89, Share 60 ..... Cored sand 3,562 ft.; prep. to test. T.D. 2,653 ft.; tested S.W.; to deepen.
Sioux Oil Co.'s No. 6 Goodrich, 200 ft. from W line and 250 ft. from E line of Blk. 3, Share 5, Porcion 81 ..... T.D. 1,387 ft.; sand 1,385-86 ft.; abnd.
William F. McGinley's No. 1 Starr County Cattle Co., 330 ft. from S, 330 ft. from W line, Blk. 20, Jeffries-Lambeth Subd. of Porcion 89, Ancient Jurisdiction of Camargo ..... T.D. 2,030 ft.; S.D.
Weekley et al's No. 1 Starr County Cattle Co., 330 ft. from S and W lines of Blk. 20, Porcion 89 (1 mi. N of Jeffries' No. 1 Lambeth) ..... T.D. 859 ft.; S.D.

UVALDE COUNTY

Evans & Johnson's No. 1 Farris, J Hammons Sur. ..... Drlg. 1,095 ft.
Humble Oil & Ref. Co.'s No. 1 R. L. Anderson, 7,450 ft. SW of NE line and 9,100 ft. SE of NW line of J. J. Guerra Sur. (3 mi. NE of Uvalde) ..... T.D. 100 ft.; moving in spudder.
T. T. Word et al's No. 1 K. S. Truelove, 650 ft. from N line and 3,000 ft. from E line of Daniel Elam Sur. No. 651 (7½ mi. NW of Sabinal) ..... Fishing 500 ft.

WEBB COUNTY

J. W. Edwards' No. 1 M. Vela, 766 ft. from E and 450 ft. from N line of Blk. 9, Sur. 267 ..... Drlg. 205 ft.
French Oil Corp.'s No. 1 Benavides, 330 ft. from S and E lines of SE of NE Sur. No. 706 (10 mi. NW of Bruni) ..... T.D. 3,201 ft.; abnd.
L. E. Lockhart's No. 1 E. Eikel, 330 ft. from N line, 940 ft. from E line of Sur. No. 1,872 ..... T.D. 2,032 ft.; abnd.
Don E. Megahan et al's No. 1 F. C. Gowdy, 330 ft. from E line, 1,450 ft. from N line of Sur. No. 2,112. T.D. 4,507 ft.; abnd.
Mankel et al's No. 1 Saldivar, Sur. 652 of J. V. Borrego grant ..... R.U.
Weekley Oil Corp.'s No. 1 R. Salvidor, 1,269 ft. from E line and 243 ft. from N line of Sec. 657, Borrego grant (SE part of county) ..... Rigged up and S.D.

WILSON COUNTY

A. P. George's No. 1 fee, 160 ft. from SE line and 300 ft. from SW line of 36.32-ac. tract in Canuto Diaz Sur. ..... Drlg. 520 ft.
Friel & Vogel's No. 1 Gutzeit, Flores grant, 150 ft. N of road and 150 ft. from W line of farm, 7 mi. NW of Floresville ..... S.D. 809 ft.
J. C. Yancey's No. 1 Lissy, D. J. Holt Sur., 1,700 ft. from SE and 6,500 ft. from most westerly SW cor. of survey ..... Abnd.

WILLIAMSON COUNTY

Atlantic-Pacific Corp.'s No. 1 W. C. Daniel, 500 ft. from SW line, 2,100 ft. from SE line of Washington P. Reese Sur. No. 3 ..... T.D. 642 ft.; rig moved off.
McLean et al's No. 2 R. C. Miller, 800 ft. to S line, 100 ft. to W line of tract, B. Manlove Sur. ..... T.D. 2,300 ft.; cleaning out.
G. L. Rowsey's No. 1-C Jas. Rieger, 725 ft. from N line, 150 ft. from E line of lease in P. Cartwright Sur. ..... Drlg. 947 ft.
Taylor Ref. Co.'s No. 4 Brockmeyer, 150 ft. from W line and 1,050 ft. from N line in H. White Sur. .... T.D. 948 ft.; est. 35 bbls. daily.
Taylor Refining Co.'s No. 5-A, Martin Brockmeyer Sur., 4,875 ft. from SE line and 350 ft. from SW line of 172-ac. tract ..... Drlg. 740 ft.

ZAPATA COUNTY

O. W. Killam's No. 9 Bruni, Share 8 of Blas Uribe tract, San Ignacio Subd., J. V. Borrego grant ..... T.D. 363 ft.; tested salt wtr.; abnd.
R. B. Morrison's No. 1 Y. and R. Ramirez, 330 ft. from NE line and 330 ft. from SE line of Blk. 4, Share 20, Porcion 19 (5 mi. from Starr County line) ..... Rigging up.
Muckelroy's No. 1 Flores, on NE line and 75 ft. from SE line of Lot 2, Blk. 30, Muckelroy Subd. of Porcion No. 37 ..... Derrick.
Joe Palmer's No. 11 S. Vela, 330 ft. from NE and SE lines of Blk. 170, Share 4 of L. Grillo grant, (3 mi. E of Redondo Pool) ..... Moving in.

Southwest Texas Proven Areas

Week Ending May 5

CEDAR CREEK POOL—BASTROP COUNTY

Marts & Bevins' No. 3 Orgain, Addison Litton Sur. .... T.D. 1,722 ft.; show oil; top Serpentine 1,640 ft.

NORTH DALE POOL—BASTROP COUNTY

Watt L. Saunders' No. 1 Harris, 1,100 ft. from SW line, 2,830 ft. from NW line of John Maximillan Sur. No. 22 ..... Drlg. chalk 2,305 ft.; top Austin 2,149 ft.

NORTH PETTUS FIELD—BEE COUNTY

United Prod. Co.'s No. 45 Ray, 2,332 ft. SW of No. 13 and parallel with N line of tract, thence SE at right angles from N line of tract, W. J. Porter Sur. ..... Coring 2,572 ft.

ECKERT POOL—BEXAR COUNTY

Alamo Nat. Gas Co.'s No. 1 Coreth, 300 ft. SE of Humble's No. 2 Coreth in A. Stafford Sur. ..... T.D. 1,055 ft.; set 6⅝-in. csg.; S.D
J. F. Harrison's No. 4 F. Gembler, 150 ft. from NW line, 460 ft. from NE line of 33-ac. tract in J. Montes Sur. ..... T.D. 831 ft.; S.D.
S. J. Moore's No. 5 T. W. Masterson, 150 ft. from S line, 175 ft. from W line of 41-ac. tract in Miguel Gortaris Sur. ..... T.D. 736 ft.; 6⅝-in. csg.; S.D.
S. J. Moore's No. 4 T. W. Masterson, 150 ft. from S and W lines of tract in M. Cartari Sur. ..... T.D. shale 695 ft.; S.D.

VON ORMY POOL—BEXAR COUNTY

Von Ormy Oil Co.'s No. 2 E. B. Carruth, 515 ft. from W line, 1,970 ft. from S line of 160-ac. tract out of 657-ac. tract in F. Rolen Sur. ..... T.D. 720 ft.; S.D.

EAGLE HILL POOL—DUVAL COUNTY

Al Buchanan's No. 5 Duval County Ranch Co., 990 ft. from E line, 330 ft. from S line of N½ of Sur. No. 206 ..... T.D. 101 ft.; S.D.
Eagle Hill Oil Co.'s No. 2 J. R. Foster, 330 ft. S of No. 1, Sur. 206 ..... 10-in. csg. at 42 ft.

GOVERNMENT WELLS POOL—DUVAL COUNTY

Bridwell Oil Co.'s No. 3 C. W. Hahl, 860 ft. from W line and 330 ft. from S line of Lot 29, or 660 ft. E of No. 1 in Sec. 250 ..... Rigging up.
Central Producers' No. 10 Tuck-Johnson, 330 ft. from N line and 330 ft. from E line of NW NW Sec. 44. T.D. 2,318 ft.; comp. 27 bbls. hr.
Central Producers' No. 12 Tuck & Johnson, 330 ft. from N and W lines of SW SW Sec. 42 ..... Rigging up.
Cox & Hamon's No. 10 Lundell-State, 330 ft. from S line and 330 ft. from W line of SW SW Sec. 60 .... T.D. 1,535 ft.; junked and abnd.
Cox & Hamon's No. 10-A Lundell-State, 330 ft. W of No. 10, Sec. 60 ..... T.D. 2,229 ft.; comp. 50 bbls. hr.
Humble Oil & Ref. Co.'s No. 22 Paul White, 330 ft. from N line and 3,224 ft. from E line of Sec. 249... Moving in rig.
Luse & Cloyes' No. 1 Haglet, 330 ft. from N and W lines of Lot 13, Section 285 ..... Moving in rig.
Magnolia Pet. Co.'s No. 25 Duval County Ranch, 660 ft. N of No. 16 in Sec. 208 ..... Drlg. 1,500 ft.
Magnolia Pet. Co.'s No. 1 L. B. Moody, 150 ft. from N and W lines of N half of SW of most easterly Sur. 60 ..... T.D. 2,364 ft.; D.S. test showed salt wtr.; abnd.
Magnolia Pet. Co.'s No. 8-A C. W. Hahl, 330 ft. from N line and 330 ft. from E line of NE of SE Sec. 45, 660 ft. N of No. 6-A ..... Sand 2,260-64 ft.; W.O.C.
Magnolia Pet. Co.'s No. 4 J. W. Riley, 990 ft. from S line and 990 ft. from E line of SW of Sec. 45, 660 ft. W of No. 3 ..... T.D. 2,363 ft.; comp. 30 bbls. hr.
Magnolia Pet. Co.'s No. 3 Paul Riley, 330 ft. from S line and 330 ft. from W line of SE NW of Sur. 45.. Rigging up.
Parr Oil Co.'s No. 2 Duval Co. Ranch, 990 ft. from S line and 330 ft. from E line of W½ of SE of Sec. 363 ..... Rigging up.
Reed-McKay's No. 3 Lundell-State, 330 ft. from N line and 990 ft. from E line of S½ of NW of Sec. 60 or 660 ft. N of No. 1 ..... T.D. 2,253 ft.; comp. 25 bbls. hr.
Reed-McKay's No. 5 Lundell-State, 330 ft. from N and E lines of SW NW of Sec. 60 ..... T.D. 2,240 ft.; comp. 20 bbls. per hour.
Reynosa Oil Co.'s No. 8-B Duval Ranch, 330 ft. from N and W lines of E half of SE Sur. 363 ..... Moving in rig.
Russ et al's No. 6-A C. W. Hahl, 330 ft. S line and 1,650 ft. from W line of N½ of SW of Sec. 46..... Drlg. sandy shale and lime 2,267 ft.
Shasta Oil Co.'s No. 3 J. R. Foster, 990 ft. from N line and 165 ft. from W line of 70-ac. tract in Sec. 206.. Moving in rig.
Southwest Drlg. Co.'s No. 1 Hahl, 330 ft. from S and E lines of SW of Sur. 56 ..... T.D. 2,514 ft.; abnd.
Sun Oil Co.'s No. 33 Weiderkehr, 330 ft. from S line, 990 ft. from E line of Sur. No. 359 ..... Location.
Sun Oil Co.'s No. 49 Weiderkehr, 660 ft. S of No. 48 and 660 ft. W of No. 46, Sur. 359 ..... Location.
Sun Oil Co.'s No. 54 Weiderkehr, 2,970 ft. from N line and 2,310 ft. from W line of Sur. 359 ..... Oil sand 2,248-61 ft.; 7-in. at 2,236 ft.; W.O.C.
Sun Oil Co.'s No. 55 Weiderkehr, 664 ft. S of No. 31 and 660 ft. W of No. 48 ..... Location.
Sun Oil Co.'s No. 56 Weiderkehr, Sur. 359 ..... T.D. 2,302 ft.; comp. 52 bbls. per hour.
Sun Oil Co.'s No. 58 Weiderkehr, 660 ft. S of No. 56 and 660 ft. E of No. 50 ..... Location.
Sun Oil Co.'s No. 59 Weiderkehr, 660 ft. S of No. 58 and 660 ft. W of No. 54 ..... Location.
The Texas Co.'s 9-A Duval County Ranch, 330 ft. W of No. 8-A and 330 ft. from N line of lease ..... Location.
Texas Co.'s No. 5 fee, Sur. 362 ..... Set 7-in. 2,288 ft.; W.O.C.
Texas Co.'s No. 8 Duval County Ranch, 2,317 ft. W and 330 ft. S of NE cor. of lease in Sec. 206, J. Pointevant Sur. ..... T.D. 2,294 ft.; comp. 30 bbls. hr.
Texas Co.'s No. 8-A Duval County Ranch, 2,320 ft. W and 330 ft. S of NE of Sec. 206 ..... T.D. 1,501 ft.; swabbing.
Trapshooter Reilly's No. 1-B C. W. Hahl, 200 ft. from W line, 330 ft. from S line of Blk. 26, Sur. 250 .... Drlg. 1,932 ft.

KINGSVILLE POOL—KLEBERG COUNTY

Ryals & Bartlett's No. 1 Flato, 150 ft. from N line, 30 ft. from W line of NE SE Sec. 40, of Kleberg Town & Improvement Co. Sur. ..... W.O.C., 90 ft.

LUCAS POOL—LIVE OAK COUNTY

Houston Oil Co.'s No. 5 Cartwright, 1,150 ft. SW line and 1,775 ft. SW line of J. M. Colchado Sur. ..... T.D. 5,018 ft.; S.D.

JACOB POOL—McMULLEN COUNTY

Jane Oil Co.'s No. 1 Lark, 150 ft. from S and 100 ft from W line of Blk. 13 ..... W.O.C., 1,048 ft.
C. R. Kennon's No. 1 Lark, 810 ft. from W line, 150 ft. from N line of 20-ac. tract, Blk. 27, Scrugham Sur. ..... T.D. 940 ft.; S.D.
Loma Oil Co.'s No. 23 Jacob, 660 ft. S of No. 11, 330 ft. from E line of lease, Sur. No. 7 ..... T.D. 1,003 ft.; S.D.
Loma Oil Co.'s No. 25 Jacob, 660 ft. E of No. 24, Sec. 5.. S.D. 852 ft.

CUEVITAS POOL—STARR COUNTY

Sun Oil Co.'s No. 6-B, M. Guerra & Son, 2,310 ft. S of Starr and Jim Hogg County lines and 2,970 ft. W of E line of Los Cuevitas Sur. ..... T.D. 2,055 ft.; D.S. test 2,047-55 ft.; 280 ft. oil in 20 min.; no gas pressure; 1,800 ft. oil in hole.
Sun Oil Co.'s No. 5-C M. Guerra & Son, 1,320 ft. NE of No. 4-C La Sacatosa grant ..... Location.

AGUA DULCE—NUECES COUNTY

Camp et al's No. 2 King, 990 ft. S of N line, 330 ft. W of E line of Sec. 24, R. Garza Sur. ..... T.D. 5,438 ft.; trying to make D.S. test.
Garland Clymore's No. 2-A Ollie Purl, 660 ft. from E line and 660 ft. from S line of Blk. 4, Section 6, Ross Peters Subd. ..... Drlg. 2,670 ft.

SAXET FIELD—NUECES COUNTY

South Mineral Oil Co.'s No. 1 J. W. Page, E. Villareal Sur., 471 ft. from E line, 160 ft. from S line of 150-ac. tract ..... T.D. 4,079, 4,073-79, D.S. test 5 bbls. oil, 75 lbs. W.P. through ¾-in. choke 5 min.; sidetracking 2,970 ft.

LOS OLMOS POOL—STARR COUNTY

Los Olmos O. & G. Co.'s No. 57 Kelsey Bass, 150 ft. from N line, 568 ft. from W line of SE SW Sec. 6, Porcions 75, 76 and 77 ..... T.D. 640 ft.; standing; depth corrected.

BYERSVILLE POOL—WILLIAMSON COUNTY

Otto Stolley's No. 1 Charles L. Byer, beginning at SE cor. of P. Cartwright Sur. SW 4,700 ft. along survey line then 950 ft. SE at right angles in P. Stoddard Sur. ..... T.D. 1,022 ft.; S.D.

JENNINGS POOL—ZAPATA COUNTY

O. W. Killam's No. 32 Cuellar, 1,410 ft. from NW line, 4,628 ft. from NE line of 17-ac. tract ..... Drlg. 1,655 ft.
Texas Co.'s No. 45 Jennings, 750 ft. N. 13 deg. 30 ft. E from Jennings' No. 39, in Cerrito Blanco grant ..... T.D. 1,219 ft.; set screen and running tubing.

Acidizing Fails to Help World's Deepest Oil Well; Oklahoma's Production Takes Drop

By JAMES McINTYRE

The Denver Producing & Refining Co.'s No. 1 A-dah-Noe, C NW SW SW Section 34-10-10w, Caddo County, the deepest oil-producing well in the world, does not appear to have been helped much, if any, by acidizing it. Eighty-five barrels of acid, loaded with 50 bbls. of oil, was shoved into the big body of sand lying between the casing point 9,910 feet, and 9,986 feet, the total depth, and the well was then shut in for 80 hours. It developed a maximum pressure of 1,700 pounds. It was opened at 10 p.m., Friday, and flowed 45 minutes steadily and 30 minutes by heads and then went dead. The well produced 325 bbls. in the 75 minutes. It was left open for two hours after it quit flowing, but performed no more. It was said that the owners contemplate deepening the hole.

In the Oklahoma City Field, the Trans Mississippi Oil Co.'s No. 1, near CWL NE NW SE Section 15-11-3w, got Wilcox sand at 6,410-6,525 feet, and the well flowed 1,449 bbls. in 8 hours and 20 minutes.

In Lincoln County, Anderson & Kerr's wildcat test, in the SW cor. Section 9-15-2, got the top of the Wilcox sand at 5,349 feet and took a core at 5,350-55 feet. The recovered part of the core showed Wilcox sand grains but with no saturation or discoloration. The crew was about to ream pipe to the total depth, 5,355 feet.

Harry Blackstock's No. 1 Lewis, NE NE SE Section 19-2n-7, in the John Fitts area in southern Pontotoc County, was drilled into Hunton lime to 3,975 feet, but it swabbed only 30 bbls. The hole then filled 1,100 feet overnight. It may be acidized, but may first be deepened.

Carter Oil Co.'s No. 1 Hanner, SW NE SW Section 24-5n-1w, McClain County, was drilling at 5,612 feet on Saturday, and was still in the Pennsylvanian.

The Phillips Petroleum Co.'s wildcat test in Garvin County, No. 1 Dennis, SE cor. NE Section 9-4-1e, was abandoned as dry at 4,670 feet.

Leasing City Lots

Skelly Oil Co. leasers are actively engaged in leasing city lots in the newly opened Oklahoma City town lot zone. The company is reported to have made purchases in Blocks 2, 3, 9, 13 and 20, in the Park Subdivision of Oak Park Addition in the N half Section 35-12-3w. Operators are looking to this north extension into the east side, and to the southwest portion of the field for a continuance of operations in the pool. There are 27 wells classified as drilling in the field, of which 17 are active and 10 shut down.

The Government's allocation of 476,400 bbls. of crude oil per day to Oklahoma was again exceeded in the week ending May 5, although production was 50,980 bbls. per day lower than in the previous week. The production in the past week was 481,375 bbls. and in the previous week 532,355 bbls. per day.

The strike of a number of Sinclair Prairie workmen in the Seminole Field, resulting in a shutdown of all Sinclair producing operations in that area, was responsible in part for the decrease in production in the Seminole-St. Louis Field to 72,280 bbls. per day, as against 97,825 bbls. per day in the previous week. A sympathetic strike was instituted by employes of the Skelly Oil Co. on Sunday, and it was reported from the Seminole area that overtures had been made to the Continental Oil Co. and Burke-Greis Oil Co. by union workmen. A meeting will be held on May 10 between the officials of the Burke-Greis company and representatives of its employes.

Oklahoma Production

Estimated daily average production in the week ending May 5 and the preceding week was as follows:

Pool—	Bbls. May 5	Bbls. Apr. 28
Allen	8,575	8,785
Blackwell district	5,000	4,900
Bristow-Slick	10,250	10,250
Cushing-Shamrock	13,500	13,500
Chandler district	7,500	7,500
Davenport	750	750
Healdton	9,300	9,300
Hewitt	5,000	5,000
Burbank	9,100	9,100
South Burbank	4,650	4,790
Balance of Osage	24,000	24,000
Lucien	10,750	11,535
Crescent	9,795	6,715
Marshall-Lovell	1,050	1,150
Bowlegs	7,995	9,965
Carr City	3,920	5,805
Earlsboro	7,075	10,720
East Earlsboro	9,110	11,500
South Earlsboro	1,130	1,295
Little River	7,585	14,750
East Little River	645	830
Seminole	8,965	11,540
East Seminole	795	915
Searight	2,090	3,030
Maud	1,305	1,300
Mission	3,205	3,970
St. Louis-Pearson	18,460	22,205
Cromwell	4,750	4,750
Pappoose	1,400	1,400
Oklahoma City	172,030	199,665
Asher-West Asher	2,000	1,990
Tatums	6,270	6,775
Sholem-Alechem	4,550	4,600
Duncan	4,550	4,550
Tonkawa-Garber-Thomas	6,750	6,750
Fish	3,380	2,850
Konawa	2,310	2,490
Gray	2,830	2,750
Graham	3,550	3,550
Holdenville	3,475	3,450
Wewoka	4,500	4,450
Yale-Jennings	5,100	5,000
Other fields	62,490	62,235
Total	481,375	532,355

Osage County

Manahan Drilling Co., Norbla Oil Co. and Gypsy Oil Co.'s No. 2 Ducotey, NE SE NW Section 3-25-6, flowed 630 bbls. in 12 hours and then was shut in. It had a hard sand at 2,757-67 feet and soft sand from 2,767-98 feet, still in sand. It was completed.

Carter Oil Co. and Norbla Oil Co.'s No. 5 Presbury, SE SW NE Section 10-25-6, flowed 1,113 bbls. in 12 hours from Burbank sand topped at 2,968 feet and drilled in 1 foot. Same operators' No. 2 Presbury, C NW NW NE Section 10-25-6, found the top of the Burbank sand at 2,677 feet and set liner at 2,678 feet.

A. H. Kasishke's No. 3 Carroll, SW cor. Section 15-25-6, was shot with 60 quarts at 2,723-61 feet and flowed 70 bbls. It was being cleaned out.

Sinclair Prairie Oil Co.'s No. 3, NW cor. Section 22-25-6, which had been shot with 40 quarts at 2,726-43 feet, and swabbed 40 bbls. in 24 hours, was later plugged back to 2,740 feet and swabbed with no better results. It was completed.

Champlin Refining Co.'s No. 2 Others, NE SE NW Section 16-24-7, found Bartlesville sand at 2,630-78 feet. It was shot with 80 quarts and flowed 449 bbls. in 15 hours. It was completed.

Lewis Production Co. and Kasishke's No. 9, SW NW NE Section 16-24-7, was shot with 150 quarts at 2,632-92 feet and swabbed 100 bbls. It had drilled into salt water at 2,700 feet and was plugged back to 2,696 feet.

Continental Oil Co. and Gypsy Oil Co.'s No. 5, SW NW NE Section 21-24-7, had Bartlesville sand at 2,645-88 feet. It flowed 60 bbls. a day naturally, but was to be given a shot.

Lewis Production Co.'s No. 3, SE NE NW Section 21-24-7, was given a 120-quart shot at 2,659-2,707 feet. It flowed 391 bbls. in 24 hours and was completed. No. 4 on the lease, NE cor. SE Section 21, flowed 120 bbls. naturally from sand at 2,684-2,714 feet.

Continental Oil Co. and Gypsy Oil Co. completed No. 3, NW cor. Section 22-24-7. It was shot with 140 quarts at 2,529-99 feet and flowed 371 bbls. in 24 hours and 282 bbls. the second day.

E. G. Todd's No. 7, NE SW SW Section 3-23-8, was shot with 120 quarts in Skinner sand at 2,075-2,113 feet and the hole filled with oil and water. It was dry in the Bartlesville sand at 2,140-93 feet and plugged back.

Indian Territory Illuminating Oil Co.'s No. 1, C SW NW SE Section 5-22-10, flowed 100 bbls. in 24 hours from Siliceous lime at 2,425-33 feet.

Ohio Osage Oil Co.'s No. 5, SW NE NW Section 34-21-9, had Layton sand at 1,098-1,111 feet. It was shot with 30 quarts and pumped 25 bbls. in 24 hours.

New work in the Osage Nation included the following operations: Reva Oil & Gas Co.'s No. 2, 1,228 feet north and 250 feet west of SE cor. Section 30-28-11, location; E. B. Lawson's No. 2, 150 feet north and 1,590 feet west of C Section 30-27-12, location; Mead Oil Co. and others' No. 7 L. DeNoya, C SW SW Section 10-25-6, building rig; Texas Co.'s No. 10, NW NW NE SE Section 30-25-8, rigging up; Norbla Oil Co.'s No. 1, NW cor. SE Section 31-24-7, location for a wildcat test; Texas Co.'s No. 1, SE cor. NW Section 12-23-7, rigging up to deepen from 1,618 feet; Pueblo Petroleum Co.'s No. 6, 375 feet north and 1,000 feet west of C Section 14-21-8, location; Maraydum Oil Co.'s No. 1, SE cor. NE Section 35-21-10, location.

In the Lucien Pool

Magnolia Petroleum Co. completed No. 1 Long, C SW SE Section 20-20-2w, Lucien Pool, Noble County. It flowed 2,451 bbls. in a potential test with a small showing of water, through 2½-inch tubing. Wilcox sands lay at 5,023-74 feet and 5,128-5,225 feet.

Lucien Consolidated's No. 2 Shoenwald, C SW NE Section 20-20-2w, flowed 5,750 bbls. in 24 hours from first Wilcox sand at 5,088-5,150 feet. It flowed 325 bbls. per hour at one period.

Lucien Consolidated's No. 3 Weber, C SE NW Section 20-20-2w, was completed. It flowed 965 bbls. in 24 hours with 150,000 feet of gas. First Wilcox sand lay at 5,025-87 feet; second Wilcox at 5,140-5,216½ feet.

Carter Oil Co.'s No. 1 Tate, C NE NW Section 29-20-2w, missed the Viola lime, Simpson dense and dolomite and got the first Wilcox sand at 4,944-70 feet and second Wilcox at 5,035-5,118 feet. It flowed 2,261 bbls. of oil and over 10,000,000 feet of gas in 24 hours and was shut in for tankage.

Stanolind Oil & Gas Co. and Amerada Petroleum Corp.'s No. 2 Bohn, C SE NE Section 29-20-2w, was completed after it had made a potential flow of 1,735 bbls. of oil and 2,000,000 feet of gas in 24 hours. About 24 bbls. of water came with the oil and gas. First Wilcox sand lies at 4,958-5,015 feet and second at 5,075-5,169 feet.

Magnolia Petroleum Co. completed No. 2 Kolb, C NW NW Section 33-20-2w. Flowing by heads hourly it made 1,472 bbls. in 24 hours from sands at 4,916-75 feet and 5,028-5,117 feet.

Lucien Consolidated was building rig for No. 4 Magney, C NW SW Section 17-20-2w, and digging pits for No. 3 Wolff, C SW NW Section 17-20-2w; Gypsy Oil Co. was rigging up rotary for No. 1 Verna, C NE SE Section 29-20-2w, and was digging pits for No. 2 Verne, C SE SE Section 29-20-2w.

Logan County

In the Crescent Pool, Logan County, Gypsy Oil Co. and Carter Oil Co.'s No. 2 Knowles, C SW NW Section 34-17-4w, was completed. It flowed 5,092 bbls.

Wildcat Operations in Oklahoma

Week Ending May 5

Northern Oklahoma

ATOKA COUNTY

Company, farm and location— Remarks:

Malernee et al's No. 1 Greenville, N. B., NW SW Sec. 35-2s-13e ..... Drlg. 1,650 ft.

ALFALFA COUNTY

Acre et al's No. 1 Acre, C SW NE Sec. 14-24-11w ..... T.D. 6,460 ft.; making a small flow of oil once a week.

BECKHAM COUNTY

West Oak Gas Co. et al's No. 1 Powell, NW SW Sec. 11-9-25w ..... Drlg. 3,353 ft.

CADDO COUNTY

Denver Prod. & Ref. Co.'s No. 1 Noe, NW SW SW Sec. 34-10-10w ..... Well acidized.

CLEVELAND COUNTY

Phillips Pet. Co. et al's No. 1 Baker, C SE NW Sec. 11-9-2w ..... Rigging up.

COAL COUNTY

Moore & Deaner's No. 1 Edward, NW NE SE Sec. 27-2-8 ..... Drlg. 4,110 ft.

Emanuel, Rudman & Hatcher's No. 1 Moyer, C SW SE NW Sec. 7-3-8 ..... Drlg. 870 ft.

Westheimer & Daube's No. 1 Lowman, C NE SE Sec. 18-2-8 ..... S.D. 4,862 ft.

CREEK COUNTY

McBride et al's No. 1-A Wickham, NE NW SE Sec. 3-15-7 ..... Wilcox sand 4,087-4,120 ft.; wtr.; P.B. to 4,066 ft.; drilled to 4,086 ft.; will acidize.

GARFIELD COUNTY

Argo O. & G. Co.'s No. 1 Dickman, SW cor. SE Sec. 13-24-1w ..... Drlg. 4,863 ft.

Ross Cummings et al's No. 1 Gage, SE NW Sec. 27-23-3w ..... Spudded.

GARVIN COUNTY

Carter Oil Co. et al's No. 1 Hanner, SW NE NW Sec. 24-5-1w ..... Drlg. 5,480 ft.

Denver P. & R.'s No. 1 Newburn, C SE SW Sec. 22-5-1e.. Drlg. 800 ft.

Phillips Pet. Co.'s No. 1 Dennis, SE NE Sec. 9-4-1e..... Dry and abd. 4,670 ft.

HUGHES COUNTY

Dickison et al's No. 1 Webster, NW NE Sec. 22-10-10.. Rig on ground.

(Continued on Next Page)

in 24 hours together with 4,500,000 feet of gas, from sand at 6,206-25 feet.

Pawnee and Creek Counties

Big Four Petroleum Co.'s No. 1 Unallotted, SW cor. NW Section 19-20-8, Pawnee County, was dry and abandoned in Bartlesville sand at 2,695-2,760 feet.

Bert Swift completed No. 1 Fields, SW cor. SE Section 7-18-10. It was shot with 160 quarts in Peru sand at 1,914-55 feet and started at 100 bbls. per day.

Jones & Doss' No. 1 Samuel, SW cor. NE Section 7-17-8, Creek County, was dry and abandoned in Jones sand at 1,535-90 feet. It missed Layton sand.

Sherry & Murta completed No. 1-A Newton, NE SW SW Section 26-17-11, Glenn Pool, in Dutcher sand at 2,146-63 feet. It is a 20-bbl. well after a shot.

Hartman and others' No. 1 Harwell, NE cor. SW NW Section 36-17-11, Glenn Pool, was drilled to Wilcox sand at 2,646-57 feet, where the hole filled with water. It was abandoned.

Devonian Oil Co.'s No. 6 Bigpond, NW cor. NE Section 36-15-7, Depew district, swabbed 50 bbls. of oil and 1½ bbls. of water in two and one-half hours from Wilcox sand at 3,753-79 feet.

Stanolind Oil & Gas Co. and Amerada Petroleum Corp. and others' No. 2 Starr, C NE SE NW Section 18-15-8, had Wilcox sand at 3,806-27 feet. It swabbed 120 bbls. in 24 hours and then was given a 10-quart shot at 3,818-27 feet and it flowed 171 bbls. in 24 hours. This well is on a community block.

New work in Creek County includes Gled Oil Co.'s No. 1 Murrell, SE NW NE Section 17-19-9, a machine; Mead Oil Co.'s No. 3 Harjo, SW cor. NW Section 35-18-8, building rig.

Lincoln County

Mid-Continent Petroleum Corp. made a location for No. 1 Ellis, SE cor. NW Section 35-15-5, Lincoln County.

There were no completions, and no new work was reported from the Chandler pools in the course of the week.

Tulsa County

L. B. Jackson's No. 2 Takee, SE NE SE Section 31-19-11, Tulsa County, had sand at 1,863-1,952 feet and a hole full of water; Mississippi lime at 2,172-2,260 feet was dry, and the hole was abandoned.

Crews and Armstrong's No. 3 Squire, C NW SE Section 8-16-14, which started at 250 bbls. a day from Glen (Bartlesville) sand at 1,523-25 feet, and then fell off in production was drilled 4 feet deeper and came back with 170 bbls. in 24 hours. It had not been shot.

Okmulgee County

Harmon Brothers completed No. 3 Harjo, SE NE SE Section 6-15-12, Okmulgee County, a 1,250,000-foot gas well at 562-66 feet, and was rigging up No. 4 Harjo, 200 feet north and 400 feet west of SE cor. Section 6-15-12.

Bryan Petroleum Co. was drilling at 500 feet in No. 1 Unallotted, SE NW SW Section 29-15-13.

Carr Peterson's No. 11 Ware, C SW SW Section 9-15-14, had Salt sand at 803-48 feet and shot it with 150 quarts. The well made 100 bbls. the first 24 hours and was completed.

J. Summers' No. 4 McKinney (twin), NW NE NW NW Section 16-15-14, was shot with 30 quarts in Salt sand at 798-807 feet and produced 15 bbls. the first day. It was completed.

Colton and Phillips Petroleum Co. completed No. 1-A Corbray, SW NE SE Section 17-14-12, in Wilcox sand at 2,752-58 feet. It flowed 85 bbls. the first day and 75 bbls. the second day. Same companies have machine in for No. 1 Adams, SE NW SE Section 17-14-12.

J. E. Wallace has machine in for No. 9 Colbert, CNL NW NW Section 14-14-14.

Hurt & Metzgar have a machine in for No. 1-A Harrison, CSL NE SE Section 2-14-15.

Curtis, Akin & Penrod completed No. 11 Fox, CSL SE SE NW Section 22-13-14. It was shot with 8 quarts in Wilcox sand at 2,454-62 feet and flowed 180 bbls. in 24 hours.

Gled Oil Co.'s No. 20 Fox, NW NE SE SW Section 22-13-14, was given an 8-quart shot at 2,449-62 feet, and it swabbed and flowed 100 bbls. in 24 hours and then 75 bbls. the second day.

Oklahoma County

Gulf Production Co. of Oklahoma's No. 1 Rucker, 906 feet south and 20 feet east of C Section 15-11-3w, Oklahoma City Field, flowed 4,223 bbls. in 12 days while cleaning out. Wilcox sand lies at 6,415-6,539 feet.

Indian Territory Illuminating Oil Co.'s No. 3 Wisel, 1,300 feet from south line and 500 feet from west line of SE Section 26-11-3w, flowed 932 bbls. in two hours and later flowed 2,634 bbls. in four hours with gas at the rate of 26,000,000 feet, in a potential test. It produces from Wilcox sand at 6,526-6,612 feet. It was completed.

Mid-Kansas Oil & Gas Co.'s No. 3 Mollman, SE NW SE Section 23-11-3w, an old well drilled deeper from 6,432 feet to 6,590 feet and where it had a dose of water and then plugged back to 6,541 feet, flowed an average of 181 bbls. of oil per day for a week. There was no water. It was completed.

New work started in the county included Knox Garvin and others' No. 1 Central Addition, 1,190 feet north and 1,208 feet west of SE cor. Section 3-11-3w, a rig; same operators' No. 2 Central Addition, 910 feet from north line and 1,156 feet from east line of SE Section 3-11-3w, rig; Phillips Petroleum Co.'s No. 3 Holstein, 984 feet from the south line and 1,151 feet from west line of SE Section 22-11-3w, location; same company's No. 3 Wallace, 984 feet north and 1,159 feet west of SE cor. Section 22-11-3w, location; Phillips Petroleum Co. and Shell Petroleum Corp.'s No. 8 Berg, NW NE SE SW Section 26-11-3w, location.

Okfuskee County

Smith and others have a machine in for No. 5 Wilson, NW NW SW NE Section 26-11-11, Okfuskee County.

Burke Greis Oil Co.'s No. 1 Harjo, SE cor. NW Section 16-10-11, was deepened from 3,012 feet to 3,030 feet, still in sand. It pumped 25 bbls. in 24 hours.

Greater Seminole Area

McGirl & Sherry completed No. 1 Unallotted, C SW SW Section 17-10-14, Hughes County. Sand at 1,602-13 feet produced 600,000 feet of gas per day. It had been drilled to 1,700 feet and plugged back.

Texas Pacific Oil Co.'s No. 1 Franklin, SW NW SW Section 10-9-4, Pottawatomie County, a wildcat, was abandoned in Hunton lime at 4,437-49 feet, total depth. It showed only salt water.

Darby Petroleum Co. and Lippa's No. 1 Nedeau, C NE SW Section 19-19-5, Seminole City area, was acidized in Hunton lime at 4,062-90 feet and flowed 112 bbls. in 24 hours.

M. I. Joyne abandoned the location for No. 1 Brown, NW SW SE Section 27-8-5, Pottawatomie County.

Mid-Continent Petroleum Corp.'s No. 3 Smith, SW SE SW Section 12-8-6, deepened from 4,293 feet to second Wilcox at 4,392-4,407 feet, found no oil but a small showing of salt water and was to be plugged back.

Vivian Oil Co. completed No. 3 Duval, SW SE SE Section 4-7-4, South St. Louis area, was completed. It flowed 1,092 bbls. the first 24 hours, naturally, and acidizing did not increase the production, coring from Hunton lime at 3,731-3,810 feet.

Phillips Petroleum Co.'s No. 2 Booze, NE cor. SE Section 9-7-4, was completed. It flowed 3,204 bbls. in 48 hours, 4 per cent sediment, and 2,000,000 feet of gas, after an acid treatment in Hunton lime at 3,733-63 feet.

Limestone Oil & Gas Co. completed No. 11 Walker, 200 feet from south line and 660 feet from east line of NE Section 15-7-8, Holdenville district, Calvin sand at 1,192-1,218 feet was shot and the well pumped 80 bbls. the first day.

Mid-Continent Petroleum Corp.'s No. 7 Factor was completed, It is a 25-bbl. well at 1,178-1,206 feet.

Kent & Preston's No. 3 Petete, 710 feet north and 510 feet east of SW cor. Section 22-7-8, was completed after it had pumped 25 bbls. in 24 hours from Calvin sand at 1,144-49 feet.

New work in the Greater Seminole area included Hoge Drilling Co.'s No. 1 Gregory, NW cor. SW Section 29-8-4, a location; Smith & Scott's No. 1 Goodin, SW NE NW Section 3-7-4, rig; Sinclair Prairie Oil Co.'s No. 3 Deathridge, SE NE NW Section 28-7-4, rig Mid-Continent Petroleum Corp.'s No. 3 Harjo (twin), NE cor. SE Section 9-7-8, machine; Morris & Hall's No. 3 Narcone, 650 feet north and 300 feet east of SW cor. Section 14-7-7, drilling at 400 feet; Mid-Continent Petroleum Corp.'s No. 3 Upton, SW NE NE Section 1-6-4, rig.

Grady County

Little Nic Oil Co.'s No. 5 Farwell, C W half NE SE Section 26-5-8w, Grady County, was completed as a gasser, starting at 1,250,000 feet per day from a sand series at 1,729 to 1,955 feet.

Pontotoc County

Texhome Oil Co. has machine rigged up for No. 2 Miller, 810 feet from south line and 1,170 feet from east line of SW Section 27-5-6, Pontotoc County.

H. & M. Drilling Co. completed No. 3 Busby, NE SE SE Section 20-5-8, a

(Continued on Page 192)

Wildcat Operations in Oklahoma

(Continued from Preceding Page)

J. B. Hill's No. 1-A Perkins, C W½ SW SW Sec. 7-5-9..S.D. 1,030 ft.
Birk-Kan's No. 1 Gardner, NE NW Sec. 22-6-9 .....Cored 3,990-96 ft.
Olympic Oil Co.'s No. 1-A McClassen, SE NW NW Sec. 12-9-8 .....Rig up.
Olympic Oil Co.'s No. 1 McClassen, SE NW NW Sec. 12-9-8 .....T.D. 600 ft.; lost tools; S.D.
Scruggs et al's No. 1 Black, NE Sec. 13-9-10 .....Drlg. 3,750 ft.

KAY COUNTY

Argo O. & G. Co.'s No. 1 Freese, SW NE NW Sec. 30-25-1w .....Drlg. 2,410 ft.

LATIMER COUNTY

Choctaw Oil & Gas Co.'s No. 1 Fleming (gas test), NE SE SE Sec. 9-6-22 .....Drlg. 1,230 ft.

LEFLORE COUNTY

East Okla. Oil & Gas Co.'s No. 1 Metcalf, SW cor. Sec. 2-4-26 .....Drlg. 1,125 ft.

LINCOLN COUNTY

Anderson & Kerr's No. 1 Huckabee, SW cor. Sec. 9-15-3..Drlg. 5,231 ft.
Harvey Newman Oil Co.'s No. 1 Rueb, C NW NE Sec. 23-15-5 .....Cellar
Mid-Continent Oil Co.'s No. 1 Bolby, NE SE Sec. 27-12-2 .....Cellar and pits.
H. W. Pierce's No. 1 McMurtry, NE cor. Sec. 6-14-5 .....Set 9-in. csg. 3,590 ft.; bailing.
The Texas Co.'s No. 1 Gessmann, SE NE Sec. 33-14-4 ....Material.

LOGAN COUNTY

Anderson & Kerr's No. 1-A Hull, 455 ft S. 330 ft. W of E cor. Sec. 11-18-4w .....Sand 4,775-4,812 ft.; flowed 287 bbls. in 24 hrs.; agitating with tools.
W. N. Anthony's No. 1 Fruin, SE SW Sec. 4-16-1 .....Tools in.
Jadeka Dev. Co.'s No. 1 Frakes, C SW NE SW Sec. 16-15-6w .....S.D. 2,531 ft.

McINTOSH COUNTY

McGirl & Sherry's No. 1 Unallotted, SW cor. Sec. 17-10-14 .....Gas sand 1,602-13 ft.; 600,000 ft. gas; comp.

NOBLE COUNTY

Continental Oil Co. et al's No. 1 Bennett, SE NW Sec. 19-20-1w .....Drlg. 1,700 ft.
Texas Co. et al's No. 1 Voss, C NE SE Sec. 28-22-2w...Drlg. 240 ft.

OKLAHOMA COUNTY

Gypsy Oil Co. et al's No. 1 Harris, C SW NE Sec. 27-13-4w .....Drlg. 3,470 ft.
Springrose Drlg. Co.'s No. 1 Edwards, C SE Sec. 19-11-1 .....T.D. 6,079 ft.; chemicalized in Hunton lime; swbd. 130 bbls. in 24 hrs.; moving out tools.

OSAGE COUNTY

Norbla Oil & Gas Co.'s No. 1, NW SE Sec. 21-24-7 .....Location.
Peters Pet. Co. and Norbla Oil Co.'s No. 1, SW cor. Sec. 15-25-5 .....Drlg. 830 ft.
Empire O. & R. Co.'s No. 1, SE NE Sec. 3-25-3 .....Sand 2,052 ft.; pumped 105 bbls. in 14 hrs.; T.D. 2,063 ft.; C.O.

PAWNEE COUNTY

Geo. Thomas' No. 1 School Land, SW cor. Sec. 13-20-5..Drlg. 1,750 ft.

PITTSBURG COUNTY

Arkhoma's No. 1 Cummings, NW NE SE Sec. 6-4-13....Fishing 515 ft.
Exchange Drlg. Co.'s No. 1 Chunn, SE NW Sec. 29-4-14..Rotary tools in.
W. E. Hailey's No. 1 Drew, NW SW Sec. 21-3-14 .....S.D. 190 ft.
Mid-Western Oil & Gas Co.'s No. 1 Shelton, CSL SE NW Sec. 7-7-18 .....Drlg. 2,306 ft.
Moffett & Hall's No. 1 Jones, C NE NW Sec. 14-8-14....Lost tools; T.D. 3,200 ft.; S.D
C. L. Carlock's No. 1 Chunn, SE NW Sec. 29-4-14 .....Rigging up.

PONTOTOC COUNTY

E. M. Blanchard's No. 1 Crabtree, NE SE NE Sec. 27-2-6..S.D. 2,920 ft.
Boyle et al's No. 1 Newbern, SW NE Sec. 31-5-4 .....Set 12-in. csg. 109 ft.
Dandridge et al's No. 1 Stafford, NW cor. Sec. 5-1-6e..Drlg. 260 ft.
Emanuel, Rudman & Hatcher's No. 1 Mayer, C SW SE NW Sec. 7-3-8 .....Drlg. 260 ft.
Delaney et al's No. 1 Dawes-Hardin, SE NW Sec. 30-3-7..Drlg. 1,250 ft.
Riddle et al's No. 1 Barnes, SE NW SE Sec. 21-5-4 .....Rigging up.

POTTAWATOMIE COUNTY

Texas Pacific's No. 1 Franklin, SW NW SW Sec. 10-9-4. Hunton lime 4,437-49 ft.; 2,500 ft. wtr. in hole.
W. E. Witt et al's No. 1 Atwater-Fundis, NE NW NE Sec. 33-8-3 .....Cellar.

SEMINOLE COUNTY

Harman Oil Co.'s No. 1 Bowlega, SE NE SW Sec. 1-7-7 .....T.D. 1,655 ft.; U.R. 5-in. csg.
Flemlee et al's No. 1 Bowlega, SE NE SW Sec. 1-7-7....S.D. 1,260 ft.
Tate & Starbuck's No. 1 Heard, SE NW Sec. 9-6-7.....Spudded.

Southern Oklahoma

ATOKA COUNTY

J. D. Boukan's No. 1 Howard, NW SW NW Sec. 20-2s-10e. Drlg. 1,135 ft.
Brookshire et al's No. 1 Rowland, NW NE NE Sec. 18-3s-10e .....S.O. 3,487-99 ft.

CARTER COUNTY

Texas Co.'s No. 1 Sullivan, NE SE Sec. 5-5s-1w.....Rig.

COMANCHE COUNTY

Miller & Goodnight Drlg. Co.'s No. 1 Welderman, NW SE SE NW Sec. 34-2n-12w .....Machine.
F. F. Stevens' No. 1 Green, SE SW Sec. 11-1n-13w.. ...Drlg. 975 ft.
Stores et al's No. 1-A Crutcher, C NE Sec. 11-1n-12w..Drlg. 375 ft.

GARVIN COUNTY

National Prod. Co.'s No. 1 Littrell, NE cor. Sec. 31-2n-3w. S.D. 299 ft.

MARSHALL COUNTY

Paul Robb's No. 1 Vittetoe, C NE SE Sec. 11-5s-4e.....T.D. 4,750 ft.; fishing.

MURRAY COUNTY

Gilcrease Oil Co.'s No. 1 Brown, SW cor. Sec. 26-1n-2e .T.D. 1,064 ft.; repairing pumps.
T. E. Revell et al's No. 1 Wolfe, NE cor. Sec. 18-1-2....Drlg. 2,218 ft.

PUSHMATAHA COUNTY

J. V. Scrivener et al's No. 1 Swink, C NE SE Sec. 29-6s-20e .....Setting csg. 410 ft.
Whitehead et al's No. 1 Messer, SE SW SW Sec. 25-3s-18e. T.D. 2,405 ft.; S.D.

STEPHENS COUNTY

J. W. Madison's No. 1 Tussey, SW SE NW Sec. 24-1n-4w..S.D. 3,210 ft.
Geo. Pace et al's No. 1 Siever, SE SW Sec. 4-1n-7w .....Drlg. 2,890 ft.

TILLMAN COUNTY

J. H. Everett's No. 1 Crane, SW cor. Sec. 15-3s-14w .....Rig.

Kansas Operators Pile Up an Overproduction of 352,000 Bbls.; May Allowable Unchanged

By JAMES McINTYRE

The Kansas Corporation Commission decided to continue the April allowable crude oil production of the State, 122,100 bbls. per day, through the month of May. As there is an accumulated overproduction of 352,000 bbls., which has been building up in the past seven months, the commission decreed that the actual production shall be under the allowable in order to reduce the overproduction. Producers have not started out the month as if they were going to underproduce, as last week's production was 130,845 bbls. per day, or 955 bbls. per day over that of the previous week.

Rig builders in the McPherson County Field went on a strike in the past week. They demand an increase in pay of $2 per day. The wage scale now is said to be $8 to $10 per day of eight hours. A dispatch from McPherson gives the number on strike as 100, but this seems to be an exaggerated figure.

Kansas Production

Estimated daily production of important pools in Kansas for the week ending May 5 and for the preceding week was as follows:

Pool—	May 5	Apr. 28
Hollow	12,555	13,085
Ritz-Canton	15,245	14,221
Voshell	7,040	8,278
Sedgwick County	7,895	7,816
Nikkell	5,895	5,824
Ellsworth County	2,965	3,478
Barton County	1,405	943
Rice County	11,659	10,302
Reno County	4,031	3,422
Ellis County	106	223
Kingman County	1,904	1,948
Stafford County	1,877	842
Russell County	6,145	7,173
Greenwood County	12,250	12,250
Butler County	17,000	17,050
Other pools	22,873	23,045
Total	130,845	129,900

Reno County

Foraker and others have cellar dug for a wildcat test, No. 1 Hiett, SE SW NE Section 34-24-4w, Reno County.

McPherson Drilling Co.'s No. 1 Matlock, NW cor. NE Section 2-24-4w, flowed 510 bbls. in 24 hours following an acid treatment at 3,371-75 feet.

Empire Oil & Refining Co. has material on the ground for No. 1 Haury-B, SW cor. Section 1-23-4w, and Study, Frost and others have made a location for No. 1 Berger, C E half NE NE Section 2-23-4w. Barnsdall Oil Co. made a location for No. 1 Sabin, NE cor. Section 11-23-4w.

Rosenthal and others' No. 1 Neufeldt, NW cor. Section 12-23-4w, pumped 350 bbls. a day from pay at 3,621-25 feet, but the well was not completed.

Sinclair Prairie Oil Co. was rigged up to drill deeper in No. 2 Base, C NW SE Section 26-23-4w, old total depth 3,334 feet. Same operator's No. 3 Base, C SE SE Section 26, swabbed and flowed 384 bbls. in 24 hours from chat at 3,329-35 feet. No. 4 on the lease, NE cor. SE Section 26, had chat at 3,249 feet and set 8-inch pipe at 3,260 feet and was waiting for cement to set.

Harvey County

Murray and Texas Co.'s No. 2 Dyck, NW NE SW Section 8-22-3w, Hollow Pool, Harvey County, was abandoned. The owners shot it once and acidized it three times and the best it would do on a 24-hour test was 4 bbls. The oil sand lay at 3,487-3,500 feet, total depth.

Hollow and others deepened No. 1 Schmidt, SW SE NW Section 17-22-3w, from 3,437 feet in shale to 3,493 feet and it made 60 to 65 bbls. per hour on the pump.

J. E. Mabee, Inc. and Shell Petroleum Corp. deepened No. 1 Martens, NE SE SE Section 19-22-3w, from 3,472 feet to 3,534 feet, and 400 feet of oil arose in the hole. It was acidized.

Producers & Refiners Corp. deepened No. 9 Martens, NE NE SW SE Section 19-22-3w, from 3,438 feet to 3,453 feet and shot it with 20 quarts. Result of the shot, if any, was not given. It will be followed by an acid treatment.

Magnolia Petroleum Co. has made a location for No. 6 Schmidt, NW SW NE Section 30-22-3w.

Regina Oil & Gas Co. completed No. 2 Vogts, C NE SE Section 8-20-1w. It pumped 294 bbls. of oil and 954 bbls. of water in a potential test. It had been acidized in Viola lime at 3,410-14 feet.

Carey and Texas Co.'s No. 4 Holt, NE SW SE Section 13-19-2w, was acidized in Viola lime at 3,405-38 feet. The well pumped 25 bbls. of oil and salt water per hour.

W. C. McBride, Inc.'s No. 5 Griffin, SW SE SW Section 14-19-2w, was completed. It pumped 653 bbls. in 24 hours in a potential test the oil coming from Viola lime at 3,372-79 feet which had been acidized.

Shell Petroleum Corp. completed No. 7 Meyers-B, C W half W half SE Section 14-19-2w. It was twice acidized at 3,357-3,402 feet and in a potential test pumped 375 bbls. in 24 hours.

Vernon and Shell Petroleum Corp.'s No. 5 Drum, SW NW NE Section 35-19-2w, pumped 35 bbls. of oil and 35 bbls. of water in 18 hours from chat at 2,910-50 feet.

Wakefield and Shell Petroleum Corp.'s No. 3 Koehn, SE NE NW Section 36-19-2w, was deepened from 2,970 feet to Viola lime at 3,385-3,411 feet. It was acidized and later pumped 80 bbls. of oil in 16 hours.

Gleason and others' No. 1-B Hamilton, NW SW SW Section 28-19-1w, had hole full of water from Viola lime at 3,469-76 feet and plugged back to 3,015 feet where it had 1,500,000 feet of gas and a 50-bbl. oil showing, which will be given a test. Top of the chat is 2,958 feet and the pay lies at 2,977-80 feet.

McKnab and others' No. 1-A Flock, NE NW SW Section 29-19-1w, was acidized in Viola lime topped at 3,425 feet, and produced an estimated 75 bbls. of oil and 18 bbls. of water.

New work started in McPherson County included the following operations: Stafford and others' No. 1 Krehbiel, NW cor. SE Section 27-21-3w (deepening from 1,340 feet), drilling at 1,900 feet; Derby Oil Co.'s No. 4 Hamm, SE SW NE Section 33-21-3w, location; J. E. Mabee, Inc. and Shell Petroleum Corp.'s No. 4 Koehn, NE SW NE Section 33-21-3w, location; same operators' No. 8 Nikkell-B, NE NW SE Section 33-21-3w, location; Rush and others' No. 1 Johnson, C SE NW Section 10-19-2w, old total depth 2,949 feet, material in to drill deeper; Helmerich & Payne's No. 6 Russell-B, SW NE NE Section 23-19-2w, cellar; No. 7 Russell-B, SE NE NE same section, location; Youker and Amerada Petroleum Corp.'s No. 1-A Roseberg, NE cor. NW Section 31-18-2w, a rig.

Rooks County

Phillips Petroleum Co.'s No. 1 Dopita, C SW SW Section 31-8-17w, Rooks County, had a hole full of water at 3,240-45 feet, total depth 3,255 feet, and plugged back to 3,217 feet, above which there was a showing of oil and water (3,205-09 feet), and acidized, but had not yet made a test.

Clay County

Seidel Brothers abandoned No. 1 Glace, NE cor. SW Section 21-9-4, Clay County, having had a hole full of water at 1,873-74 feet, total depth.

Russell County

Central Petroleum Co. had rig up for No. 1 Dortland-B, NE SE NW Section 4-14-15w, Russell County.

Ellsworth County

Smith & Ash and others' No. 1 Wilkins, SE cor. Section 13-17-10w, Ellsworth

(Continued on Page 206)

Wildcat Operations in Kansas

Week Ending May 5
(Descriptions are East unless marked otherwise)

BARTON COUNTY

Company, farm and location—
National Ref. Co.'s No. 1 Ingersoll, C NW NE Sec. 2-19-13w ..... Drlg. 455 ft.
Skelton et al's No. 1 Ott, C SE SE Sec. 16-19-14w ..... **P.B. to 3,255 ft.; acidized; pumping wtr.**
Walter Shearen et al's No. 1 Kempler, SE NE NE Sec. 31-18-11w ..... Spudded.

BUTLER COUNTY

DeGenther et al's No. 1 Marnane, NW cor. Sec. 29-26-3.. Cellar.
L. C. Hay et al's No. 1-A Bolin, SE SW SE Sec. 36-26-6.. Drlg. 1,560 ft.
Tom Palmer and Darby Pet. Co.'s No. 1 Harder, NW NE Sec. 27-24-3 ..... T.D. 2,565 ft.; U.R. 6-in. pipe.
Van Meter et al's No. 1 Moore, NE cor. Sec. 5-25-4 ..... **Rig.**

CLAY COUNTY

Seevers et al's No. 1 Myers, NE NW NW Sec. 4-10-4 .... Drlg. 590 ft.
Seidel Bros.' No. 1 Glace, NE SW Sec. 21-9-4 ..... Chat 1,834 ft.; 5 to 10 bbls. oil at 1,873 ft.; S.W. 1,873-74 ft.; abd.

DICKINSON COUNTY

Dutch Oil Co.'s No. 1 Phillips, C NE NW Sec. 15-15-1e.. T.D. 935 ft.; running 12-in. csg.

ELLIS COUNTY

Alma Pet. Co. et al's No. 1 Rhodes estate, SW SW Sec. 14-11-23w ..... Drlg. 2,845 ft.

ELK COUNTY

Diller O. & G. Co.'s No. 1-A Keys, C E½ SE NE Sec. 26-21-10 ..... Machine.
Lerke et al's No. 1 Mason, C NE NE Sec. 5-31-10 ..... U.R. csg. 900 ft.
B. Taylor et al's No. 1 Wilson, SE NE SE Sec. 5-28-10 .. Machine.

ELLSWORTH COUNTY

Smith & Ash et al's No. 1 Wilkins, SE cor. Sec. 13-17-10w ..... Acidized 3,260-80 ft.; pumped 160 bbls. oil and 25 bbls. water.

FINNEY COUNTY

National Ref. Co. et al's No. 1 Smith, C SE SW Sec. 2-23-29w ..... T.D. 1,800 ft.; fishing for tools.

GREENWOOD COUNTY

Ackman et al's No. 1-A Gilroy, SE SW NW Sec. 24-25-12. Drlg. 150 ft.

HARPER COUNTY

Wood Bros.' No. 1 Anthony, C SW SW Sec. 17-31-9w .... Surface pipe set.

HARVEY COUNTY

Foraker et al's No. 1 Hiett, SE SW NE Sec. 34-24-4w .... Cellar.
Wenzel et al's No. 1 Schrag, NW SE Sec. 24-22-3w ..... Rig.
Lassen, Bruce et al's No. 1 Joseph, NW NE Sec. 13-24-2 ..... Spuded and S.D.

KINGMAN COUNTY

Kessler et al's No. 1 Bollinger, SW NW SW Sec. 12-28-5w ..... Rigging up.

LYONS COUNTY

Arkman & Baker's No. 1-A Hind, NE NW Sec. 30-21-12.. Drlg. 400 ft.

McPHERSON COUNTY

Tom Palmer's No. 1 Nordling, SE SW Sec. 19-18-2w ..... TD. 2,187 ft.; U.R. 10-in. csg.
Slick, Pryor & Lockhart's No. 1 Ordineal, SE SW SE Sec. 21-20-3w ..... Drlg. 3,364 ft.
Continental Oil Co. et al's No. 1 Graber, NE NW Sec. 32-21-1w ..... Drlg. 2,501 ft.
Jim Madison's No. 1 Boesker, SE NW Sec. 29-20-1w ..... Spudded.

OSAGE COUNTY

Jim Edwards' No. 1 Detrich, C NW SE Sec. 21-14-15 .... Machine.

PHILLIPS COUNTY

Ashby et al's No. 1 Close, C SE Sec. 24-5-18w ..... Drlg. 3,285 ft.

RENO COUNTY

Atlantic Oil Prod. Co.'s No. 1 Phillips, C E½ NW NE Sec. 22-22-6w ..... Spudded.
L. H. Wentz' No. 1 Metcalf, SE NE SW Sec. 3-24-7w ... Location.

RICE COUNTY

Aylward & Trees' No. 1 Belder, SW SE NE Sec. 27-20-7w ..... Rigging up.
Continental, Empire and Shell's No. 1 Bennett, NW SE Sec. 25-18-8w ..... Drlg. 1,034 ft.
Deitrick et al's No. 1 Fitzpatrick, C NE NE Sec. 30-21-8w ..... S.D. 1,505 ft.
Elwell et al's No. 1 Springer, NE NW Sec. 35-18-10w... Drlg. 580 ft.
Geo. Dickey et al's No. 1 Hunter, NE cor. Sec. 35-19-7w.. Drlg. 3,705 ft.
Langston et al's No. 1 Markle, NE SW Sec. 1-20-9w ... T.D. 1,185 ft.; S.D. for repairs.
Reserve Dev. Co.'s No. 1 Heinz, NE SW SE Sec. 8-18-10w. T.D. 2,130 ft.; U.R. 10-in. csg.

ROOKS COUNTY

Seeley et al's No. 1 Doughty, C SW SW Sec. 15-8-19w.. Spudded and S.D.
Phillips Pet. Co.'s No. 1 Dopita, C SW SW Sec. 31-8-17w.. H.F.W. 3,240-45 ft.; P.B. to 3,217 ft. and acidized.

RUSSELL COUNTY

C. L. Price et al's No. 1 Bender-B, NW SE Sec. 10-16-13w ..... Material.
Western Exploration Co.'s No. 1 Andres, SW cor. Sec. 30-15-12w ..... Drlg. 3,339 ft.

SEDGWICK COUNTY

D. Lauck and Shoreline Oil Co.'s No. 1 Jordan, NW SW SE Sec. 6-28-1w ..... Wilcox 3,652-53 ft.; flowed 166 bbls. oil in 24 hrs. with 140 bbls. wtr.; testing.
Sovereign Oil Co.'s No. 1 Nichols, C NW SE Sec. 20-25-1w ..... Drlg. 360 ft.

STAFFORD COUNTY

Vickers Pet. Co. and Phillips Pet. Co.'s No. 1 Cravens, SW NE Sec. 15-25-11w ..... Viola 3,920-22 ft.; acidized.

SUMNER COUNTY

Morgan & Flynn's No. 1 Mercer, NW NE NW Sec. 36-32-1w ..... Rigging up.
Wentz and Continental Oil Co.'s No. 1 Kerns, SE cor. NE Sec. 6-34-2w ..... H.F.W. 4,692-4,705 ft.; abd.

TREGO COUNTY

Central Commercial's No. 2 King, C SE SW NE ..... Drlg. out cave; T.D. 4,015 ft.

WOODSON COUNTY

Lewis Bros.' No. 1 Riggs, SW cor. Sec. 10-26-14 ..... Set pipe at 765 ft.; S.D.

Five Completions in North Louisiana, All Small; Arkansas Activity Centered in Southwest

By J. R. CRUMPTON
Staff Correspondent, Louisiana-Arkansas

SHREVEPORT, La., May 7.—North Louisiana district reported five completions during the past week, all of them small producers from the Zwolle and Converse Fields of Sabine Parish. The only other completion reported was from Rapides Parish, Central Louisiana. A total of six new locations were staked, two in the gas areas of Morehouse and Ouachita Parishes and the remainder in the proven areas of Sabine Parish.

In the Converse Field, the Florence Oil Co.'s No. 2 Cranford, Section 20-9-13, used acid at 1,975 feet and was completed at that depth pumping 15 bbls. daily. In Section 9-9-13, the Helena Oil & Gas Co.'s No. 2 J. W. Tatum was a 50-bbl. pumper from 2,034 feet, and the Sabine Royalties Co.'s No. 1 Graham, Section 20-9-13, is pumping 15 bbls. daily from 2,001 feet. In the East Zwolle Field, the Magnolia Petroleum Co.'s No. 2 Peterson, Section 10-7-11, also used acid and was completed as a 50-bbl. pumper from 2,748 feet. George L. Pace's No. 1 H. C. Phillips, Section 30-8-11, is flowing 175 bbls. daily from 2,316 feet. In Rapides Parish, J. C. Prine's No. 1 Baum, Section 27-6n-2e, was dry and abandoned at 3,125 feet. The log on the well shows the base of the Jackson at 1,390 feet with a show of gas at 1,812 feet. Another show of oil was reported at the base of the Cane River at 3,000 feet.

NORTH LOUISIANA

Although no new wildcats were staked during the past seven-day period, increased activity is noted in seven parishes of the North Louisiana district. The Eastern Texas Oil Co.'s No. 1 First National Bank of Gibsland, Section 15-17-7, Bienville Parish, is rigged up and ready to spud in. This block was assembled by J. P. Evans, independent operator of Shreveport, and a contract let to the former company on a division of the acreage. The test is located near interior salt domes where several wildcats have been drilled during the past few years, all of which had excellent showings of both oil and gas. In Bossier Parish, just across Red River from Caddo Parish, John F. Anderson's No. 1 Leonard, Section 19-19-13, has cored a likely looking core of hard lime, containing some sand from 3,082 feet. In the same parish, northeast of the Sligo gas field, the Producers Oil & Gas Co.'s No. 1 W. H. Werner, Section 7-17-11, has set 7-inch casing at 2,846 feet to test a potential gas sand which should be contacted around the 3,200-foot level. This sand, which was picked up in the proven area of the gas field, is thought to be either in the Washita or Fredericksburg in the upper part of the lower Cretaceous between the Woodbine and the Glen Rose of the Trinity series. The well has a contract to drill to 4,500 feet to the Trinity unless a commercial well is completed at the present depth.

A Caddo Parish test being watched with interest is the Arkansas-Louisiana Pipe Line Co.'s No. 1 Rodessa Oil & Land Co. in Section 23-23-16. The well is a wildcat a few miles northeast of the proven gas field and has set 10-inch casing at 3,008 feet. Gas is produced in the field to the southwest around the 5,500-foot level from Oolitic lime of the Glen Rose in the upper Trinity. In the proven area of the field, two tests are active, one of which is testing for oil below the gas bearing horizon. R. W. Norton's No. 1-B J. B. French, Section 34-23-16, is cutting tubing and a short string of 4½-inch casing from the hole which was cemented together in running the casing a few weeks ago. The bottom of the hole is 6,717 feet, and it is understood that another short string of casing will be run as soon as the hole is clean. In the same area, the United Gas Public Service Co.'s No. 1 Sallie Dees, Section 28-23-16, is drilling in lime and shale at 3,891 feet. In a wildcat area in the southern part of Caddo Parish, A. D. King, trustee's No. 1 Sallie Roach, Section 4-14-16, failed to make a well in the chalk rock at 1,540 feet and is drilling at 2,128 feet. This test has a contract to drill to 4,000 feet, but a recent show in the chalk resulted in the test with barren results.

DeSoto Wildcats

DeSoto Parish has eight active wildcats in operation. L. H. Alderson's No. 1 P. B. Peek, Section 25-11-13, is drilling at 525 feet after setting 12½-inch casing at 65 feet. S. J. Barber's No. 1 Tom Haton, Section 4-11-11, is coring at 2,688 feet, and Dempsey-Manziel's No. 1 T. D. Thigpen, Section 33-13-13, is coring at 1,251 feet with the top of the Nacatoch logged at 1,177 feet. W. F. Flynn's No. 1 Nabors, Section 6-12-11, tested dry in chalk at 1,177 feet and is using acid at 1,312 feet in an attempt to make a producer from this formation.

E. T. Oakes' deep test near the town of Longstreet, No. 1 Bryant, Section 30-13-15, is coring at 5,042 feet, and the Sunrise Oil Co.'s No. 1 Wemple, Section 14-12-11, is drilling at 2,655 feet. In Section 1-10-13, J. S. Tuffree's No. 1 McGill set 12½-inch surface casing at 40 feet and is drilling at 1,015 feet. In Grant Parish, L. L. Lindsey is arranging to set 7-inch casing to test a sand reported from 2,330-42 feet in his No. 1 Edenborn, Section 13-7-4. The Triangle Drilling Co.'s No. 1 W. A. Colvin, Section 31-20-3w, Lincoln Parish, topped the anhydrites at 3,702 feet and is drilling at 4,090 feet. In Natchitoches Parish, the Pennsylvania Southern Petroleum Co., Inc., is moving in rig on its No. 1 Chopin Lumber Co., Section 4-5n-5w. In the same parish, Plummer & McDaniel are arranging to rig up on their No. 1 Walmsley, Section 45-10-8, a wildcat located on a 6,000-acre block. Kincaid & Kelly's No. 1 J. Ober, Section 5-14-10, Red River Parish, has set 10-inch surface casing at 84 feet and drilling will be resumed within the next few days. This test is located on a 4,800-acre block with a contract to drill a 2,900-foot hole. In the same parish, A. D. Mytilen's No. 1 Louisiana Delta Pecan Co., Section 27-13-11, has set 8-inch casing on top of a likely looking sand at 785 feet and will test. Sabine Parish has two interesting wildcats drilling outside of the proven and semiproven areas of Converse and Zwolle. In the Spring Ridge area south of Pleasant Hill, D. D. Alexander's No. 1 P. H. Brown estate, Section 9-9-11, has set 10-inch surface casing at 146 feet and is drilling at 1,320 feet. This test is in the immediate vicinity of a gas well and oil well brought in about two years ago from the Washita or Fredericksburg formations, but has failed to date to make a commercial field. In the southern part of the parish, M. J. Kissick's No. 1 Barr, Section 6-4-12, is coring at 1,875 feet.

ARKANSAS

Most of the activity in this district is concentrated in the southwestern part of the State in Miller and Lafayette Counties. E. L. Young, trustee's No. 1 Patterson, Section 5-19-28, in the southwestern part of Miller County, has been inactive during the past week while the owners are curing titles in the block. This well caused quite a ripple of excitement about two weeks ago by recovering a 6-foot core from 3,660-66 feet, the top of which was saturated with oil. Northeast of the Young test and south of the same fault line, J. K. Wadley, trustee's No. 1 Deckerman, Section 24-17-27, has set 10-inch casing at 147 feet and is drilling at 1,594 feet. This test, along with two others mentioned last week that will be drilled south of this fault extending over into Lafayette County, will be closely watched by the oil fraternity in this division. It is understood that Wadley and Erwin's block centering around Section 19-16-23, southwest of Stamps in Lafayette County, will be drilled by Ralph Davidson, independent operator of Shreveport. The contract calls for a 3,500-foot hole with drilling operations to begin immediately.

The Miller County Field, east of Texarkana, has five active rigs. The King Oil Corp.'s No. 1 C. H. Schroder, Section 24-14-28, is drilling at 1,830 feet, and C. E. Murdock's No. 1 E. L. Beck, Section 33-15-26, has spudded in and set 10-inch surface casing at 108 feet. Frank Roe's No. 1 Olivet, Section 4-16-26, set 10-inch surface at 130 feet, and the Texarkana Oil Corp.'s No. 1 H. E. Beck, Section 34-15-26, is coring for the pay sand at 2,840 feet. Lee Timberlake's No. 1 E. L. Beck, Section 33-15-26, has spudded in and is waiting on surface casing at 60 feet. In Union County, E. R. Henderson's No. 2 J. H. Ogden, Section 32-18-14, has rebuilt derrick destroyed by fire a few weeks ago while treating with acid at 2,208 feet and will make a second attempt to increase production by using acid. Another active test in this county is the Marine Oil Co.'s No. 1-B Union Saw Mill Co., Section 2-18-13, Urbana Field, drilling in red beds at 3,400 feet. The McCresslen Oil Co.'s No. 1-A Doty Norman, Section 3-18-13, is drilling at 1,715 feet, and the same company's No. 1-B Hadley, same section, has set 7-inch casing at 3,549 feet. Both of these wells are in the Urbana area.

Estimated daily average production of all fields for the week ending May 5 follows:

NORTH LOUISIANA	
Caddo, light	4,575
Caddo, heavy	1,595
Converse	1,845
Cotton Valley	660
De Soto and Red River	1,530
Elm Grove	345
Haynesville	3,700
Holly	190
Homer	2,650
Pleasant Hill	215
Sarepta-Carterville	740
Urania	2,760
Zwolle	5,330
Total	25,535

SOUTH ARKANSAS	
Champagnolle	1,235
El Dorado	2,485
Lisbon	250
Miller County	895
Nevada	735
Smackover, light	2,370
Smackover, heavy	19,770
Stephens	605
Urbana	1,990
Total	30,535

Wildcat Operations in Louisiana-Arkansas

(Rotary operations unless otherwise designated)

North Louisiana

AVOYELLES PARISH

Company, well, farm name, section and block—	Remarks:
Haas & Stokes' No. 1 Lindstrum Land Co., 490 ft. S, 980 ft. E. NW cor. Sec. 34-1n-6e	Set 12-in. 40 ft.

BIENVILLE PARISH

Eastern Texas Oil Co.'s No. 1 First Natl. Bank, 330 ft. N and E, SW cor. NE NE Sec. 15-17-7	Rigging up.

BOSSIER PARISH

Bossier O. & G. Co.'s No. 1 Sherrill, 300 ft. S and W, C. B. Duffield's No. 2 Werner, Sec. 11-18-13	Dry and abd. 2,625 ft.
Ford & Hanover's No. 1 Cryer, 330 ft. S and W, NE cor. NW SW Sec. 25-19-12	P.B. to 872 ft.; tested S.W.
McKinney & Stewart's No. 1 Nattin, 470 ft. W, 620 ft. S, NE cor. Sec. 22-22-14	D.S. stuck 2,850 ft.
Producers O. & G. Co.'s No. 1 Werner, 660 ft. N and W, SE cor. Sec. 7-17-11	Set 7-in. 2,846 ft.

CADDO PARISH

Ark.-La. P. L. Co.'s No. 1 Rodessa Land Co., 1,290 ft. N, 645 ft. W, SE cor. Sec. 23-23-16	Set 10-in. 3,008 ft.
W. T. Bell et al's No. 1 Bostick, 1,320 ft. E, 660 ft. N, SW cor. Sec. 12-22-16	Set 10-in. 52 ft.; drlg. 935 ft.
W. O. Bliss' No. 1 McDade, 330 ft. N and E, SW cor. NW NW Sec. 2-20-15	W.O.S.R. 1,640 ft.
Burkett O. & G. Co.'s No. 1 Lindholm, 400 ft. S and E, NW cor. NE SE Sec. 15-17-14	S.D. 1,046 ft.; repairing rig.
A. D. King, tr.'s No. 1 Roach, 641 ft. E, 375 ft. N, SW cor. SE Sec. 4-14-16	S.D. 2,128 ft.

CALDWELL PARISH

Terrell & Price's No. 1 La. Central Lbr. Co., 300 ft. N, 200 ft. W, SE cor. NW NE Sec. 15-11-3e	Sidetrack D.S. 850 ft.; T.D. 2,080 ft.

CATAHOULA PARISH

T. R. Hincey's No. 1 Millsaps, Sec. 33-9-6e	Rigging up.

DE SOTO PARISH

L. H. Alderson's No. 1 Peek, SE cor. NW NE Sec. 25-11-13	Drlg. 525 ft.
Berry Oil Co.'s No. 1 Wemple, Sec. 14-12-11	Drlg. 2,655 ft.
Dempsey & Manziel's No. 1 Thigpen, 375 ft. S, 330 ft. W, NE cor. SW NE Sec. 33-13-13	Coring 1,251 ft.
W. B. Flynn's No. 1 Nabors, 330 ft. N, 400 ft. W, C Sec. 6-12-11	Using acid 1,312 ft.
Geo. M. LeGrand's No. 1 Fulmer, 200 ft. N and W, SE cor. NW SW Sec. 1-11-16	Moving in rig.
J. S. Tuffree's No. 1 McGill, 450 ft. N, 150 ft. W, SE cor. SW SE Sec. 1-10-13	Drlg. 1,015 ft.

LINCOLN PARISH

Triangle Drlg. Co.'s No. 1 Colvin, 660 ft. E of C Sec. 31-20-3w	Drlg. 4,090 ft.

(Continued on Page 203)

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Among Gulf Coast Drilling Contractors

George H. Echols, one of Gulf Coast's most active contractors, has 10 rigs running, one for Houston Oil Co. in East Texas; one for the Windsor Oil Co. at Tomball; one for Atkins-O'Neil and others at Laward, Jackson County; one for the Humble Oil & Refining Co. at Greta; one for the Stanolind Oil & Gas Co. at Greta; one for the Sun Oil Co. at a deep test at San Diego; one for the Windsor Oil Co. in Duval County; one for the Sun Oil Co. at Guerra, Starr County; one for Atkins-O'Neil and Continental Oil Co. in the new Odom Field, San Patricio County, and one for the Circle W Oil Corp. in the Odom Field.

Smith & McDannald have five rigs running, one at Louise for the Pure Oil Co.; one at Greta for the Stanolind Oil & Gas Co.; one at Duson, La., for the Superior Oil Co. of California; one in East Texas for the Tide Water Oil Co., and one at Livingston for themselves, where they already have two producers. This firm recently hung up a new Gulf Coast record when they landed 8,915 feet of 7-inch casing in the Superior Oil Co.'s wildcat at Duson, La.

New Location at Van Vleck

Rutherford Drilling Co., that recently completed a 7,000-foot well in the Van Vleck area for the Skelly Oil Co., is setting up on a new location in this field for Skelly. The company is also drilling a test for the American Liberty Oil Co. at Rockport in Aransas County, Texas.

Harvey & Rush have one rig running at Kountz, Tex., for Frazier and Greer, and just completed a 7,085-foot hole at Richmond, Tex., for the Phillips Petroleum Co.

Edwards Drilling Co. has five rigs running at widely scattered points, one at Buffalo for the Shell Petroleum Corp., one at Goose Creek and one at Big Creek for itself, and one at Franklin, La., and one at Church Point, La., for itself and others.

C. & R. G. Drilling Co. (Gus Cormier) is starting a rig in Victoria County for itself and Brown & Neffley and Dick Sawyer. Another rig is preparing to spud in for Dick Schwab on a location south of Schwab City in the Livingston area.

Cron & Gracey have six rigs running at this time, three on contracts for the Shell Petroleum Corp. at Iowa, La., two for the Barnsdall Oil Co. at Iowa, and one for the Shell Petroleum Corp. in East Texas.

J. E. Hooper, formerly Gulf Coast superintendent for the Sinclair Oil Co., recently entered the contracting business and is now drilling a well for the Chicago Gulf Corp. near Anahuac, Chambers County, Texas.

T. B. Cochran Drilling Co., Clarence Farris, superintendent, is drilling a well near Aldine, Tex., for the American Liberty Oil Co. This well has attracted considerable interest.

H. W. Bass, formerly of the firm of Champlin & Bass, has two rigs running at Cayuga for the Tide Water Oil Co.

Five Rigs Running

Rowan Drilling Co. has five rigs running, one for the Amerada Petroleum Corp. about 15 miles south of Angleton, Brazoria County; one for Amerada-Stanolind at Tomball; one for the Tide Water Oil Corp. at Cayuga; one for Rowan & Nichols in East Texas, and one for the Humble Oil & Refining Co. in East Texas.

Mid-Continent Drilling Co. has contracted to complete Floyd Scott and Marley Production Co.'s No. 1 Klintworth-Kurten Dome in Brazos County, Texas. They have also contracted with the same company for a 6,000-foot test on No. 1 Odom, south block of the Kurten dome.

J. S. Abercrombie has one rig running on his own acreage in East Texas.

Turnbull & Irwin have one rig running in the Whitlock Survey in Liberty County, Texas, now below 5,000 feet.

DeArman Brothers Drilling Co. has two rigs running on acreage owned by the company in East Texas.

Carpenter Drilling Co. has cemented casing in a well located on its own acreage at Sour Lake, Tex. This is a deep test.

Heavy gasoline rig owned by George Echols, and used for drilling where water is scarce and fuel is difficult to transport. The power unit behind the draw works, including two Model WOK Waukesha 150 h.p. engines, extended drives and reverse clutch, were furnished by the Portable Rig Company, of Houston. This rig is now on location in Duval County for the Windsor Oil Company

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New Producing Area in Eastern Acadia Parish; Practically Proven Field in Jackson County

By A. C. EASTERWOOD
Gulf Coast Bureau, The Oil and Gas Journal

HOUSTON, Tex., May 7.—The discovery of a new producing area in the extreme eastern limits of Acadia Parish on the Bosco geophysical prospect, with a practically proven new field for Jackson County, along with another test to be drilled in the Splendora area of eastern Montgomery County, and several wildcats throughout the area nearing their critical depths, has made a very interesting week for the Gulf Coast district.

Superior Oil Co.'s No. 1 P. O. Hermandes, about 4 miles north of Duson, held a very important part in the activities of the Gulf Coast during the week, when it came in flowing at the rate of 31½ bbls. of oil per hour through twelve-sixty-fourths inch choke with 1,360 pounds pressure. This rank wildcat, now flowing around 800 bbls. daily, has operated a new field which will probably encompass parts of Acadia, Lafayette and St. Landry Parishes, and has brought about one of the most extensive royalty and leasing campaigns ever witnessed in the area.

The well was drilled to a total depth of 8,916 feet in sand and set a string of 7-inch casing at 8,830 feet. Plugs were never drilled and a very unusual completion program followed. Operators made eight perforations from 7,845-50 feet and before bringing in the well, two drill stem tests were made and each showed 20 bbls. of oil with wash water and mud in 20 minutes, or an average flow at the rate of 60 bbls. per hour.

It topped the Discorbis at 7,629 feet, encountered Heterostegina at 7,940 feet and had top of Marginulina at 8,360 feet. Surface elevation is 53 feet. Four miles of pipe line is being laid from Duson to the well, where operators have about 4,000 bbls. storage. This well marks the entrance of Superior to the Gulf Coast and is near the center of a 6,500-acre block leased by Pure Oil Co. about nine years ago.

Extension Campaign

A very active drilling campaign is scheduled for the area. Due to the expiration date of some of the leases six locations have already been staked and all will be drilled simultaneously, marking the second extensive wildcat drilling program of this type ever undertaken on the Gulf Coast. The first was carried on by the Pure Oil Co. at Louise in Wharton County, where it had eight wells drilling at one time. Concrete foundations are being poured for two wells, and locations are being cleared and roads built for four. Five additional rigs are being moved in, three from Wichita Falls, Tex., and two from Oklahoma City. Four of the locations were staked in Acadia Parish and two in St. Landry Parish. In Acadia Parish one location was staked on the Mervine-Kahan company acreage in Section 33-8s-3e, one on the Leza Mier tract in Section 33, one on the J. Sydney Arceneaux land in Section 33, and one on the Lovinski Richard tract in Section 34. Across the line in St. Landry Parish one location was made on the Mercellus Savoie land in Section 27, and the other on the Ursin Iseringhausen tract in Section 35.

In the extreme southwest part of Acadia Parish, Shell is reported to have a three-instrument torsion balance crew working the area, while Gulf company also has a three-instrument torsion balance crew working the southeast part of the parish. Magnolia is reported working on the western edge of the parish and west of Iota with a reflection crew.

Jackson County

About a mile from the town of Vanderbilt in Jackson County, Encio Gas Co.'s No. 1 Toney, a rank wildcat in the Raymond Musquiz Survey, showed favorably, possibly opening a new oil field, when on a drill stem test at 5,523 feet open 7½ minutes with three-eighths inch chokes on top and bottom, it showed 33 fourbles of fluid, 2 mud and the remaining 31 fourbles 31.5 gravity oil. However, the well is said to have shown no pressure. Sand with streaks of shale was cored from 5,575-82 feet, which is the present total depth. The 7-inch casing was cemented at 5,518 feet and at last report operators were waiting on cement to set and it will probably be the first of the week before plugs are drilled. Humble Pipe Line Co. is laying a mile line from the well to a loading rack at Vanderbilt. All available acreage is said to have been taken, with Humble, Magnolia and Phillips the principal leaseholders. Royalty near the well is bringing around $150 per acre. Atkins & O'Neil's No. 1 Ward, in Block 8, I.&G. N. Survey No. 18, showed 32 thribbles of salt water and with 2 thribbles of sand and mud through three-eighths inch choke in eight minutes on a drill stem test from 5,944-57 feet. It also had a slight odor of oil. Late in the week it was reaming sand at 6,250 feet.

Splendora Area

In the Splendora area of eastern Montgomery County, Humble Oil & Refining Co. is building road and clearing location for No. 1 Texas Long Leaf Lumber Co., which will be one of the most watched wildcats in the Gulf Coast. The location has been made little more than a mile north and slightly east of Steen's No. 1 Texas Long Leaf, which has held much interest for several months. The new location is 466 feet out of the southeast corner of Humble's north 2,000-acre tract in the Walker County School Land Survey. Steen Drilling Co.'s No. 1 Texas Long Leaf was drilling 2,835 feet in shale after plugging back to 2,300 feet, where it accidentally sidetracked hole while running casing. It will probably be carried to the 5,800-foot horizon and completed for a gas and distillate well. The well topped the Cockfield at 5,815 feet and had sand from 5,855-77 feet, where it built up 350 pounds pressure in three and one-half minutes and recovered 2½ gallons of distillate on a drill stem test. It also showed one joint of brown distillate on a drill stem test from 5,873-84 feet. The well was formerly carried to a total depth of 6,053 feet, where it tested salt water.

West of Conroe

Baker and others' No. 1 Benker, about 3 miles west of Conroe and in the D. James Survey, made two drill stem tests from 4,525-4,625 feet, both of which failed. At last report it was shut down. McElroy Oil Corp.'s No. 1 Grogan Cochran Lumber Co., west of Conroe and north of Goodwin, was drilling shale at 3,968 feet. Elevation is 183 feet.

Southwest of Cleveland

Nearing the critical depth is Gulf Production Co.'s No. 3-C Kirby Lumber Co., southwest of the Cleveland discovery well in Liberty County, which was drilling below 5,413 feet in shale. On top of the Hockley it is running about 28 feet lower than No. 1 well and about 138 feet lower than No. 2. Top of the Hockley was encountered at 4,870 feet actual or 4,747 feet subsea. Gulf's No. 1, the discovery well, topped the Hockley at minus 4,719 feet, and No. 2 had Hockley at minus 4,609 feet. Gulf's No. 2 Kirby, just south of the discovery well, is drilling for the Sparta, found in the lower section of the Cook Mountain, and late in the week was about 8,573 feet in brown shale. It topped the Crockett member of the Cook Mountain around 7,004 feet.

About 15 miles east and a little south of the Cleveland area, Turnbull & Irwin's No. 1 Hildebrandt, in the W. Whitlock Survey, was drilling at 6,002 feet. H. Sample was spudding No. 1 Security Trust Co., in Lot No. 3, J. Faulk Survey, about 9 miles east and south of the Cleveland area.

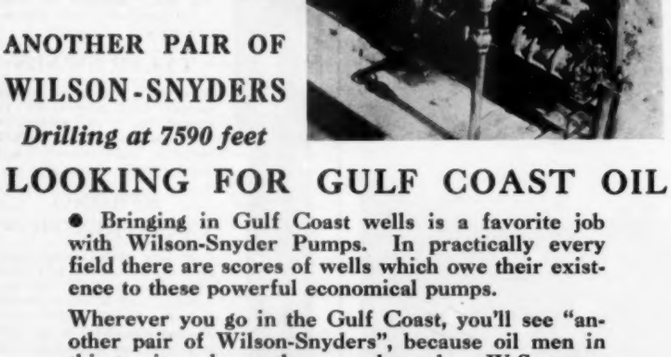
Raccoon Bend

Humble Oil & Refining Co.'s No. 1 Zeiske, the Cockfield sand discovery well at Raccoon Bend in Austin County, has been completed for 392 bbls. per day through one-quarter inch choke with 440 pounds tubing pressure. The oil tested 34.6 gravity. It drilled 22 feet of broken sand and shale with hole bottomed at 4,047 feet. Top of the Cockfield was encountered at 3,841 feet. Humble is reported to have purchased the William Remmert 100-acre tract in the W. C. White Survey for a well. Acreage and royalty have been changing hands quite briskly since the discovery of Cockfield production in the area.

In the northwest corner of the county, Sun Oil Co. has spudded No. 1 Zetik and late in the week was drilling around 200 feet. It is in a 104-acre tract in the S. M. Williams Survey. Gem Oil Co. and Johnson Brothers' No. 1 Haedge, in Block 18 of the San Felipe de Austin Survey, was coring 5,666 feet. It topped the Hockley at 4,852 feet actual or 4,671 feet subsea.

Brazoria County

Miramar Oil Corp.'s No. 2 M. Hogg, the new deep sand discovery at West Columbia in Brazoria County, has been completed for 700 bbls. oil daily through three-eighths inch choke with 25 per cent salt water. The well first came in making about 50 per cent salt water but has steadily been decreasing. Oil tested 39 gravity. Tubing pressure was 650 pounds and casing pressure 1,150 pounds. It was carried to a total depth of 6,050 feet and plugged back to 5,196 feet to



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the sand it had passed up from 5,137-90 feet.

Along the Brazoria and Galveston County lines and just north of the town of Alvin a nice lease play has been in progress during the past two weeks with Stanolind Oil & Gas Co. and Standard of Kansas thought to be the principal purchasers. Stanolind is reported to have taken a block of around 3,500 to 4,000 acres in the area. Standard of Kansas is reported to have recently shot the area. Southeast of Stratton Ridge in Brazoria County, Sun Oil Co. is reported working up a block of over 5,000 acres.

At High Island in Galveston County, D-E-M Oil Co. has completed No. 1 Great Western for a good shallow producer. The well bottomed hole at 149 feet in rock and has been put on the pump for 7½ bbls. per hour.

Calhoun County

In the southern part of Calhoun County Continental Oil Co. is moving in rig for No. 1 American National Realty Co., for a test to be drilled in the center of the NE of Section 6, Block C, between Seadrift and O'Connor.

Hardin County

Parr and others' No. 1 Benard, the new deep sand discovery on the east edge of the old Sour Lake Field in Hardin County proved rather disappointing when operators failed after several days of swabbing in an effort to bring the well in. Late in the week it was coring ahead at 6,998 feet in sand and shale. The well came in about three weeks ago estimated good for about 1,000 bbls. daily in sand from 6,936-52 feet, but killed the well to set screen. Operators used 350 sacks of baroid and opalite and it is the general belief the producing sands have been sealed off.

Greer and Frazier's No. 1 O. Sternberg, north of Kountze and in the H.&T.B. Survey No. 283, was drilling at 5,667 feet in sticky shale. It topped the Heterostegina at 3,524 feet and encountered top of the Vicksburg at 5,190 feet actual or 5,113 feet subsea. Sun Oil Co. is reported to have taken a tract just east of the well.

Harris County

South of the Bammel area in western Harris County, American Liberty Oil Co.'s No. 1 Clappert, on a drill stem test at 6,625 feet open 27 minutes through one-quarter inch choke showed 12 thribbles of mud with 9 thribbles of salt water. At last report it was shut down. In the Goose Creek Field of Harris County, Gulf Production Co.'s No. 23-A Wright has been completed for 209 bbls. daily, 36 per cent of which is salt water. Total depth is 4,014 feet. The active drilling campaign for the new deep sand production in the area has showed no signs of abating.

Matagorda County

At Buckeye in Matagorda County, United North & South Development Co.'s No. 1 Unit 6, deepest drilling well in the Gulf Coast, was circulating with total depth of 9,457 feet. No. 1 Unit 4 was drilling sand and shale with a show of oil and gas at 7,848 feet.

Conroe Trend

On the easternmost flanks of the Texas Conroe trend in Newton County, Tide Water Oil Co. and Darby Petroleum Co.'s No. 1 Southwest Lumber Co. has been abandoned as dry with total depth of 5,848 feet. It topped the Cockfield at 5,208 feet and had top of the Yegua at 5,658 feet actual or 5,517 feet subsea.

Wharton County

At Louise in Wharton County, Pure Oil Co.'s No. 1 W. Garrett is preparing to abandon with total depth of 6,543 feet.

Polk County

The Livingston Field in Polk County marked up two completions. Owenby's No. 2 Kimes in the A. Viesca Survey, bottomed hole at 4,336 feet and was completed for 60 bbls. per hour through one-half inch choke with 566 pounds tubing pressure and 900 pounds casing pressure. Top of sand was encountered at 4,315

(Continued on Page 192)

Gulf Coast Fields and Wildcats

Week Ending May 5

RACCOON BEND—AUSTIN COUNTY

Humble O. & R. Co.'s No. 4-B Rufus Hardy, 2,086 ft. from S line and 430 ft. from W line of Sec. 49, J. Groce grant ..... Drlg. 667 ft.

Humble O. & R. Co.'s No. 5 L. B. Sherwood, W. C. White Sur., Abst. 101 ..... Drlg. 688 ft.

MANVEL—BRAZORIA COUNTY

Company, farm and location—	Remarks:
Burton Drlg. Co.'s No. 1 Parker, 40 ft. E and 70 ft. S of SW cor. of Lot No. 28, H.T.&B. Sur. No. 63	T.D. 5,355 ft.; show oil 5,330-35 ft.; preparing to make D.S. test.
Shell Pet. Corp.'s No. 2 Gubert, 268 ft. from N and 325 ft. from E line of Lot 29, C. O'Donnell Sur. No. 74	Location.
Shell Pet. Corp.'s No. 3 Gubert, 70 ft. from S line and 40 ft. from W line of Lot 28, C. O'Donnell Sur.	Location.
Texas Co.'s No. 1 Boff, 265 ft. from S and 325 ft. from W line of C of Lot 24, H.T.&B. Sur. No. 74	T.D. 6,009 ft.; D.S. test 5,185-5,208 ft., 7 min., 22 fourbles salt water; slight show oil.
Texas Co.'s No. 1 Cascio, 200 ft. E of Scopel lease and 330 ft. at right angles SW of Belcher "B" lease	Drlg. shale 5,052 ft.
Texas Co.'s No. 1 F. Lieder, 330 ft. from S line and 262 ft. from W line of Lot 9, H. M. Little Sur.	Drlg. shale and lime 2,748 ft.
Texas Co.'s No. 1 W. D. Morrison, 743 ft. from N and 441 ft. from E lines of lease, C of Lot 33, A.C.H.&B. Sub., Sec. 91	Rigging up.
Texas Co.'s No. 1 Helen J. Way, NE cor. of 50-acre tract in Lot 20, Thos. Spragging Sub.	Rigging up.

STRATTON RIDGE—BRAZORIA COUNTY

Amerada Pet. Corp.'s No. 5 Seaborn, Austin-Williams Sur., 600 ft. E of No. 3 and 329 ft. S at R/A	Fishing stuck drill stem 7,202 ft.

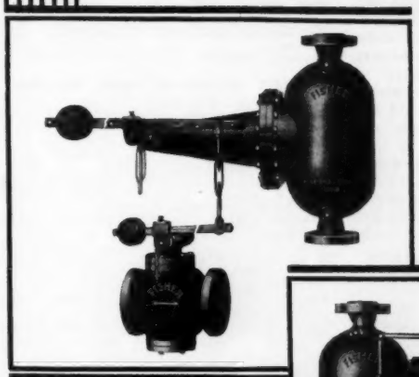
WEST COLUMBIA—BRAZORIA COUNTY

Miramar Oil Corp.'s No. 1 Hogg, Martin Varner league (second hole), 75 ft. N of first hole	T.D. 6,010 ft.; P.B. 5,196 ft.; comp. 700 bbls. day net oil through ¾-in. choke with 25 per cent S.W.; T.P. 650 lbs., C.P. 1,150 lbs.; 39 gravity.

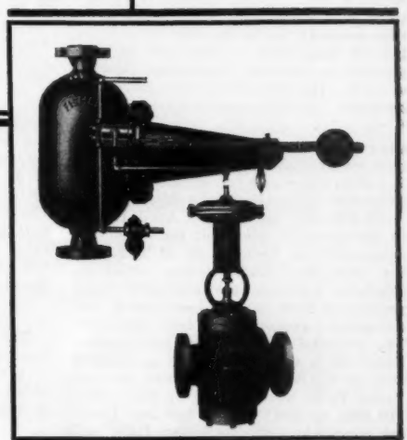
BARBERS HILL—CHAMBERS COUNTY

Mills Bennett Prod. Co.'s No. 3-B Gulf fee, 25 ft. out of SE cor. of lease	Spudding.
Mills Bennett Prod. Co.'s No. 3-C Gulf fee, 442 ft. W along S line and 710 ft. N at right angles to S line	Drlg. shale and lime 5,663 ft.
Humble O. & R. Co.'s No. 5-B Kirby, Henry Griffith League, 925 ft. W of E line, 537 ft. N of S line of tract	T.D. 4,777 ft.; cmtd. to 4,223 ft.; drlg. cmt. and salt 4,354 ft.
Moody Corp.'s No. 5-A E. W. Barber, 100 ft. E of W line and 70 ft. N of S line of lease	T.D. 1,115 ft.; W.O.C.
Moody Corp.'s No. 6-A Barber, 75 ft. W or E line and 400 ft. N of S line of lease	Location.
Sinclair Prairie Oil Co.'s No. 15 Wilburn, Henry Griffith League, 150 ft. W of No. 14	Drlg. shale 4,989 ft.
Sinclair Prairie Oil Co.'s No. 17-A Wilburn, 150 ft. W of No. 13	Top salt 1,380 ft.; T.D. 2,039 ft.; sidetracked at 1,266 ft.; drlg. salt 1,404 ft.

(Continued on Page 200)



TYPE 232C
Left: Complete ball bearing equipped Level Control, direct-operated.



TYPE 235D
Right: Remote type Level Control with pilot valve and diaphragm main valve.

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Engineers Recognize FISHER Reliability As Proved By Their Demands

Engineers have never been more careful in their selection of equipment for refinery construction than in the past few months when it has been necessary to hold costs to a minimum but to be absolutely certain dependable equipment was installed.

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Status of the California Marketing Agreement Is Expected to Be Determined in Few Days

By L. P. STOCKMAN
Staff Correspondent, California Fields

LOS ANGELES, Calif., May 7.—Status of the marketing agreement which California refiners and marketers have been formulating for the past month is expected to be determined within the next few days as it has been signed by all but four eligible participants. One of the four holdouts has tentatively agreed to sign but the other three have not yet shown any inclination to do so. When refiners started framing the marketing agreement about a month or so ago, it was generally understood the movement would fail to accomplish its primary purpose unless the agreement was approved by each and every refiner. This statement of policy is of particular interest due to the possibility that three or four small refiners may thwart efforts of the majority. Refiners signing the agreement would be at a distinct disadvantage if two or three marketers refuse to co-operate as this minority would be able to pick up hot oil from time to time and be in a position to undersell signatories. Because of this, the status of the marketing agreement is still uncertain.

Potential production of the state showed a substantial increase during the past month with the result that on May 1 California was given credit for a potential of 1,244,945 bbls. compared with 1,229,165 bbls. per day on April 1. Due to the uncertain status of the marketing agreement and the necessity of harmonizing production and refining activities, schedules covering the allowable daily production have not yet been issued, but temporary quotas have been assigned. The potential production of Los Angeles Basin fields was increased from 462,605 bbls. to 473,865 bbls. while San Joaquin Valley fields were stepped up from 636,110 bbls. to 640,835 bbls. per day. Pending completions at Kettleman Hills and in the Mountain View Field should result in a substantial increase in the potential of San Joaquin Valley during the present month. Potential daily production of the coastal area dropped on May 1 from 130,450 bbls. to 130,245 bbls.

Small Production Decline

Crude oil production showed a small decline during the week. Production jumped to 500,000 bbls. May 4 and 5 and offset the 460,000-bbl. average for the first part of the week.

California blossomed out again with another new production code this month and from all indications it will come in for considerable condemnation from certain producers. This new code is expected to dovetail into the projected marketing agreement. Under the present setup, substantial revisions will be made in the allowable quotas of several fields to equalize the production of all members of the proposed agency scheduled to be established if the marketing agreement is approved.

The concerted attempt to stabilize production and marketing activities on the Pacific Coast will prove of great importance to all lines of business if successful. This will be felt by equipment manufacturers as it will stimulate drilling activities in proved fields and lead to further exploration work. Drilling operations have shown a consistent increase for several months but still have a long way to go before getting back to normal. R. D. Bush, state oil and gas supervisor, reports permits have been taken out for 168 new wells during the year compared with 82 at the same time last year. Deepening and redrilling jobs total 115 for the current year compared with 57 at the same time in 1933.

Mountain View

The Mountain View Field of Kern County is rapidly assuming the aspect of a real oil field as each week sees additional locations and new rigs. Acreage is held in relatively large blocks in contrast with the town lot sections of many other fields and drilling is progressing more along normal lines. All leases require offset drilling but one has more leeway in the development as a few days' delay is not as vital as when developing town lots in a highly competitive area. One of the most important factors is the broadening of the scope of operations. Operators are following the general trend but there is a very definite indication they have decided to increase the amount of drilling. Some of this is due to offset requirements but new wells will be started on proved acreage within a few weeks.

The A. T. Jergins Trust has staked locations for three wells and is rigging up rotary drilling equipment in another. The Mohawk Oil Co. is making preparations to undertake additional drilling and the Union is building rig for No. 1 Wible to begin making hole on May 15. Standard Oil Co., while testing the water shutoff on No. 1 Nichols, was obliged to pump in mud when it started to blow oil and gas. This well is bottomed at 5,631 feet and should be given an early production test with excellent prospects. Over in the Edison area, Monterey Exploration Co. has been getting some excellent showings in No. 3 Duff at 3,200 feet. It may lead to additional drilling if completed as a commercial producer. This well is on a new structure or accumulation.

Kettleman Hills

Several new wells are scheduled for early completion in the North Dome of Kettleman Hills with the result the potential daily production should register a further substantial increase. Union Oil Co., which is developing the King lease in conjunction with Amerada Petroleum Corp., should finish No. 5 within 15 days unless some unforeseen complication arises. In No. 1 Lillis-Welsh, Union has been making splendid progress to the present depth, 10,170 feet, but it is a little too early to say the company will be able to reach the original depth of 10,944 feet as previous attempts by the North Kettleman Oil & Gas Co. met with disaster because the bit invariably drilled into the old hole which was junked because of mechanical trouble. It is the present intention of Union to drill to approximately 11,000 feet if possible and land a string of casing around 10,400 feet. Kenda and the Standard both have several potential producers nearing completion, one of which, the latter's No. 38-19-J, should be tanking oil before the close of another fortnight.

Ventura Avenue

Associated Oil Co. has started preparations to redrill and deepen 10 wells on the Dabney-Lloyd lease in the Ventura Avenue Field and several additional crews are on the job. Wells on this lease to be rejuvenated include Nos. 5, 7, 16, 18, 19, 31, 33, 40, 44 and 67. This is the first extensive amount of work undertaken in this field in several years as operators have been doing only a limited amount of drilling to enhance curtailment. In addition to this work on the Dabney-Lloyd lease, Associated is rigging up rotary tools on two wells on the Lloyd lease preparatory to drilling. General Petroleum is making a water shutoff test on No. 13 Notten, a projected deep test scheduled to be completed in the 57 zone at about 8,600 feet. Shell, which is drilling several wells expected to be finished within 30 days, has staked location for No. 81 Taylor.

There was no great change in drilling operations in the Elwood Field of Santa Barbara County although progress was made in all of the drilling wells. Union Oil Co. has spudded in on the Cal Coast lease in the Santa Maria Field and the bit is at 1,520 feet. Continental Oil Co. has spudded in No. 3 Grubb in the San Miguelito Field of Ventura County but it will be several months before this project is completed due to the depth and because the company is not pushing drilling operations as aggressive work would tend to void the curtailment program. Woodrow Oil Co. lost circulation in No. 1 Lomas, a deep well in the Rincon Field at 7,611, while redrilling at 5,460

TANKER SHIPMENTS FROM LOS ANGELES TO DOMESTIC AND FOREIGN PORTS

	April 22		April 15			
Intercoastal-domestic—	Total this week	Daily average	Total last week	Daily average	This year to date	Same time last year
Fuel oil	248,338	35,477	410,018	58,574	4,980,981	442,722
Diesel and gas oil	46,683	6,669	.....	.....	781,119	1,014,084
Gasoline	75,732	10,819	.....	.....	1,721,081	2,399,568
Kerosene	.....	.....	78,721	11,244	427,386	411,076
Other finished oil	15,171	2,167	.....	.....	15,171	30,635
Other unfinished oil	.....	.....	.....	.....	.....	72,584
Foreign exports—						
Crude oil	65,821	9,403	264,653	37,808	2,273,899	2,299,688
Fuel oil	96,934	13,848	325,315	46,474	3,782,070	2,248,726
Diesel and gas oil	36,392	5,199	193,204	27,601	1,327,107	984,775
Gasoline	70,923	10,132	44,958	6,423	1,213,151	1,923,208
Kerosene	168,954	24,136	28,487	4,070	454,815	657,053
Other finished oil	.....	.....	.....	.....	3,529	.....
Other unfinished oil	92,908	13,273	.....	.....	127,271	.....
Coastwise-domestic—						
Crude oil	285,705	40,815	200,943	28,706	3,249,465	3,856,090
Fuel oil	108,565	15,509	185,432	26,490	3,657,387	3,336,052
Diesel and gas oil	.....	.....	8,826	1,261	250,431	488,360
Gasoline	440,207	62,887	137,888	19,698	3,519,598	3,770,272
Kerosene	7,923	1,132	8,118	1,017	57,964	67,123
Naphtha distillates	.....	.....	.....	.....	.....	27,651

TANKER SHIPMENTS FROM SAN FRANCISCO TO DOMESTIC AND FOREIGN PORTS

Intercoastal-domestic—						
Diesel and gas oil	.....	.....	.....	.....	448,113	280,531
Gasoline	.....	.....	.....	.....	72,625	239,016
Kerosene	.....	.....	.....	.....	197,498	406,405
Lubricants	10,025	1,432	.....	.....	18,331	8,250
Foreign exports—						
Crude oil	76,467	10,924	.....	.....	593,567	629,722
Fuel oil	97,973	13,996	.....	.....	332,102	252,511
Diesel and gas oil	.....	.....	.....	.....	580,126	412,181
Gasoline	104,243	14,892	90,998	13,000	1,157,875	1,562,913
Kerosene	.....	.....	20,025	2,861	232,220	332,768
Lubricants	.....	.....	.....	.....	58,458	52,456
Other finished oil	2,760	394	.....	.....	2,760	3,745
Other unfinished oil	.....	.....	.....	.....	5,750	12,322
Coastwise-domestic—						
Fuel oil	115,640	16,520	45,934	6,562	1,119,825	858,056
Diesel and gas oil	.....	.....	.....	.....	87,029	153,041
Gasoline	32,406	4,629	68,823	9,832	1,250,947	1,135,961
Kerosene	.....	.....	.....	.....	44,690	57,531

IMPORTANT SOUTHERN CALIFORNIA WILDCATS

Company, well and location—	S-T-R	Depth	Status
Clayton, G. L., No. 1 Clearwater, Los Angeles Co.	31- 3-12	6,450	sd. sh. drilling
Pacific Dev. Co., No. 1 Watts, Los Angeles Co.	16- 3-13	3,879	suspended
Clark & Miller, No. 1 Hermosa, Los Angeles Co.	31- 3-14	rig	rigging up
Dominguez Oil Co., No. 1 Dominguez, Los Angeles Co.	34- 3-12	4,770	redrilling
Quinn, J. B., No. 1 Dominguez, Los Angeles Co.	3- 4-13	4,067	redrilling
Kelly & Son, No. 1 Torrance, Los Angeles Co.	7- 4-13	6,435	suspended
Wehrman, J. K., No. 1 San Pedro, Los Angeles Co.	14- 5-14	1,660	hd. sd. drilling
Nudson, T. T., No. 1 Inglewood, Los Angeles Co.	17- 2-14	2,690	sd. sh. drilling
Scientia Oil Co., No. 1 Inglewood, Los Angeles Co.	7- 2-14	rig	suspended
Standard Oil Co., No. 1 Inglewood Deep, Los Angeles Co.	7- 2-14	1,020	sd. sh. drilling
Kieps Oil Co., No. 1 Inglewood, Los Angeles Co.	17- 2-14	rig	rigged up
Wilshire, No. 2 Potrero Deep, Los Angeles Co.	27- 2-14	6,461	sd. sh. drilling
Community Oil Co., No. 1 Montebello, Los Angeles Co.	34- 1-11	7,447	plug 5,555 ft.
Community Oil Co., No. 2 Montebello, Los Angeles Co.	34- 1-11	...	material
Universal Consd., No. 1 Montebello Deep, Los Angeles Co.	5- 2-11	7,331	sd. sh. drilling
Universal Consd., No. 2 Montebello Deep, Los Angeles Co.	5- 2-11	6,950	suspended
Universal Consd., No. 3 Montebello Deep, Los Angeles Co.	5- 2-11	7,680	suspended
Texas Co., No. 1 Montebello Deep, Los Angeles Co.	6- 2-11	6,570	sd. sh. drilling
Standard, No. 1 Montebello Deep, Los Angeles Co.	6- 2-11	4,507	sd. sh. drilling
St. Helens, No. 1 Montebello Deep, Los Angeles Co.	6- 2-11	2,546	sd. sh. drilling
Frontier Oil Co., No. 1 Pico, Los Angeles Co.	7- 2-11	924	sd. sh. drilling
Midfield Oil Co., No. 1 Pico, Los Angeles Co.	19- 2-11	4,000	sd. sh. drilling
Rex Anglin Dev. Co., No. 1 Los Nietos, Los Angeles Co.	29- 2-11	798	suspended
Eldorado Pet., No. 1 Puente, Los Angeles Co.	30- 2- 9	3,116	suspended
Barstow Oil Co., No. 1 Saugus, Los Angeles Co.	35- 5-16	2,136	suspended
Alpha Oil Co., No. 1 Calabasas, Los Angeles Co.	22- 1-18	1,339	resuming work
International Dev. Co., No. 1 Saugus, Los Angeles Co.	34- 5-16	201	sd. drilling
Alexander, W. L., No. 1 Sunland, Los Angeles Co.	7- 2-14	1,284	hd. sd. drilling
Black Eagle Oil Co., No. 1 Huntington, Orange Co.	tideland	3,985	suspended
Nuoil Co., No. 1 Newport, Orange Co.	29- 6-10	6,465	fishing D/P
Harding, John, No. 1 Fairview, Orange Co.	9- 6-10	697	portable outfit
Speik Oil Co., No. 1 Fairview, Orange Co.	9- 6-10	rig	rigging up
Placentia Dev. Co., No. 1 Placentia, Orange Co.	31- 3- 9	4,531	redrilling
Mid-Rich Drlg. Co., No. 1 Atwood, Orange Co.	26- 3- 9	360	suspended
Rubens, Sy., No. 1 Atwood, Orange Co.	19- 3-19	3,368	suspended
Bardeen Pet., No. 1 Coyote, Orange Co.	13- 3-10	4,182	hd. sd. drilling
Bridger, J., No. 1 Coyote, Orange Co.	15- 3-10	506	sd. sh. drilling
Severns Drlg. Co., No. 2 Coyote, Orange Co.	24- 3-11	7,272	rigging up
Great American Pet., No. 1 Chino, San Bernardino Co.	18- 2- 8	2,642	suspended
Great American Pet., No. 2 Chino, San Bernardino Co.	18- 2- 8	2,761	sd. sh. drilling
Tehama Pet., No. 1 Santa Ana Canyon, San Bernardino	33- 2- 8	1,295	test W.S.O.
San Diego Pet. Co., No. 1 Chula Vista, San Diego Co.	32-18- 2	1,663	sd. sh. drilling

feet with the result that the drill pipe stuck.

Mount Poso

Several new wells will be started in the Mount Poso Field of Kern County within 15 days and this district will experience a rather active life during the next three months. Union has spudded in No. 1 S.&M. which should be finished within three weeks. Texas Co. has started rig construction for No. 5 Vedder and Modoc Oil Co. is installing rotary drilling equipment in No. 2 Johnson. Shell has concluded drilling operations on No. 7 Security at 1,748 feet and a production test should be made within a day or two. Golden Bear Oil Co. has recompleted No. 4 Grimes pumping 190 bbls. of 15.5 gravity oil per day after plugging back the hole from 2,745 feet to 2,738 feet. Hugh Adams also listed a recompletion by returning No. 2 Glide to production pumping 150 bbls. per day after redrilling the hole to 1,780 feet.

Two new wells are expected to be finished in the Midway-Sunset Field of Kern County within 10 days as Honolulu Oil Corp. is making preparations to swab in No. 23 in Section 14-32-23 and Standard is drilling out cement in No. 6-15-D on the adjoining section. Both projects should result in commercial production. In the Coffee Canyon area, Helm & Bailey's No. 2 Coffee proved wet on a production test at 1,737 feet after the hole had been plugged back from 1,757 feet and further work will be required. Western Gulf, discoverer of the Fruitvale Field of Kern County, is swabbing No. 13-B on the K.C.L. lease in this field after redrilling the hole to 3,352 feet with bottom at 3,860 feet. Cascade Oil Co. has just spudded in No. 2 in Section 23-29-27 and is drilling below 500 feet.

Lost Hills-Belridge

Suspension of drilling operations on No. 1 Williamson in the Lost Hills Field by Associated Oil Co. a few weeks ago temporarily removes this district as a possible disturbing factor. Failure to develop deep production in the Lost Hills Field has proved a distinct disappointment to a number of operators as it tends to disprove the theory Temblor or Eocene production should normally be expected in all fields along the western rim of the San Joaquin Basin. One or two wells do not, of course, definitely disprove the existence of deep production in this field but this unsuccessful work will tend to discourage further exploration for some time.

General Petroleum has been delayed in No. 1 Berry, a deep test in the South Belridge Field, for several weeks due to having encountered small pieces of iron in the bottom of the hole at 10,961 feet. This well is the deepest hole in the world and consequently operators are hoping for an early recovery, especially since the log shows considerable gas pressure. The probability of developing commercial oil production in this well is more or less conjectural at present. Union Oil Co. should reach the projected completion depth in No. 18 Belridge in the North Belridge Field within a week or 10 days. Belridge Oil Co., which proved deep production in the North Belridge Field about two years ago, is drilling two holes in this area. In the interests of conservation, the Eocene is not being drilled. Standard Oil Co. is making normal progress in its McKittrick wildcat in Section 15-30-22, but is not deep enough to pick up the pay.

Long Beach

Three wells were put on production in the Long Beach Field of Los Angeles Basin although only one showed favorable production. This was Rafair Oil Co.'s No. 1 Signal which was brought in pumping 148 bbls. of relatively clean 27.1 gravity oil per day from the upper zone at 3,820 feet. Southern California Drilling Co.'s No. 2 Miller, finished at 4,972 feet, was brought in pumping 336 bbls. of 26.8 gravity oil per day but the output is cutting approximately 36 per cent. Trinity Oil Co.'s No. 1 Strode completed pumping 177 bbls. of 25.4 gravity oil per day from 4,444 feet also showed a rather high cut and may require further work.

Standard Oil Co. is making preparations to begin drilling operations on two new wells in the Huntington Beach Field and, judging by present work, should finish No. 65-B along about May 15. Drilling operations in this field have dwindled to an infinitesimal amount and future completions will be less frequent. The Standard, which is drilling four new wells in the West Coyote Field of Los Angeles Basin, should complete the entire quartet before the close of the current month. Standard is doing this work under normal conditions and not to stimulate production. The company has adopted the policy of suspending production activities immediately subsequent to completion. Severns Drilling Co., which recently finished an outpost as a commercial producer is rigging up rotary drilling equipment in No. 2 McNally preparatory to resuming drilling. This well was originally drilled by Petroleum Securities several years ago but developments indicate it was not carried deep enough. The McNally lease is around the edge of the West Coyote structure and does not afford very many favorable locations.

Dominguez

Republic Petroleum Co., which is developing a 40-acre lease in the Dominguez Field of Los Angeles Basin, should be in a position to conduct a production test on No. 5 Childs within 15 days. Mutual Oil Co.'s No. 1 Carpenter, a recent completion in the Dominguez Field, is holding up in good shape although the cut is reported to have shown a slight increase during the past two weeks. Union and Shell are doing limited development and both should list at least one new producer before the end of the month. In the East Coyote Field Bardeen Petroleum Co. is drilling in No. 1-C at 4,150 feet with only minor showings.

Operators in the Inglewood Field of Los Angeles Basin are stepping right along with their projected development program and within a fortnight it appears probable there will be five wells making hole. Standard Oil Co. is rigging up two new wells and has rig finished for another. Pacific Western Oil Co. has about finished rigging up No. 17 Rubel. This well is scheduled to be carried into the Miocene. It is not the intention to produce the well if a deeper zone is picked up as it is merely being drilled

IMPORTANT NORTHERN CALIFORNIA WILDCATS

Company, well and location—	S-T-R	Depth	Status
General Pet., No. 9 Capitan, Santa Barbara Co.	32- 5-30	rig	rigged up.
Shell Oil Co., No. 2 Capitan, Santa Barbara Co.	32- 5-30	1,771	pumping test
Lincoln Drlg. Co., No. 3 Summerland, Santa Barbara Co.	21- 4-26	2,803	suspended
Dietzmann, J., No. 1 Summerland, Santa Barbara Co.	16- 4-26	3,829	suspended
Fairview Oil Co., No. 1 Purisima, Santa Barbara Co.	18- 7-34	2,186	cemented
Barnsdall-Rio Grande, No. 8 Doty Elwood, Santa Barbara	15- 4-29	4,868	plug 3,525 ft.
Signal Oil & Gas Co., No. 2 Elwood, Santa Barbara Co.	tideland	5,415	prod. test
East Elwood Pet. Co., No. 1 Elwood, Santa Barbara Co.	14- 4-29	609	sd. sh. drilling
Midland Pet. Co., No. 1 Goleta, Santa Barbara Co.	9- 4-28	rig	rigging up
Cuyama Oil Co., No. 1 Cuyama, Santa Barbara Co.	12-10-27	4,002	suspended
Union, No. 2 Santa Maria, Santa Barbara Co.	19-10-33	....	location
Woodrow Pet., No. 1 Rincon, Ventura Co.	4- 3-24	7,612	D/P stuck
Continental, No. 3 San Miguelito, Ventura Co.	23- 3-24	rig	rigging up
Hancock Oil Co., No. 1 Fillmore, Ventura Co.	13- 4-19	3,357	plug pipe leak
Oil Ridge Oil Co., No. 1 Fillmore, Ventura Co.	1- 4-19	642	cleaning out
Oak Mountain Oil Co., No. 1 Sespe, Ventura Co.	1- 4-20	2,697	br. sh. drilling
Kneiper & Atha, No. 1 Bardsdale, Ventura Co.	7- 3-19	1,710	suspended
Duke Oil Co., No. 1 Bardsdale, Ventura Co.	6- 3-19	....	material
Williamson & Donaher, No. 1 Simi, Ventura Co.	36- 3-18	900	sd. sh. drilling
Dabney, H. R., No. 1 Simi, Ventura Co.	22- 2-18	1,505	suspended
Prop. Service Corp., No. 1 Lloyd, Ventura Co.	24- 3-23	mtl.	bldg. rig
Laing & Jacobs, No. 1 Shiells, Ventura Co.	32- 4-19	701	suspended
Kirk, W. A., No. 1 Sulphur Mountain, Ventura Co.	21- 4-22	1,954	cleaning out
Mosher, J. W., No. 1 Santa Paula, Ventura Co.	22- 4-21	1,920	cemented
Las Posas Pet., No. 1 Las Posas, Ventura Co.	22- 3-20	6,135	suspended
International Oil Developers, No. 1 Conejo, Ventura Co.	33- 3-20	3,068	hd. sd. drilling
Hub Pet. Co., No. 1 Gould Hills, Kern Co.	22-29-21	6,840	suspended
Shell Oil Co., No. 1 Gould Hills, Kern Co.	21-29-21	4,141	sd. sh. drilling
Standard Oil Co., No. 1 McKittrick, Kern Co.	15-30-22	1,931	sd. sh. drilling
Casa Mira Oil Co., No. 1 Belridge, Kern Co.	29-28-29	4,982	land 9-in.
General Pet., No. 1 Belridge, Kern Co.	30-20-21	10,960	cleaning out
Union Oil Co., No. 18 Belridge, Kern Co.	36-27-20	7,010	br. sh. drilling
Wrenn, J. J., No. 1 Antelope Plain, Kern Co.	32-25-17	1,701	suspended
Associated, No. 1 Lost Hills, Kern Co.	2-26-20	7,858	suspended
Inland Pacific, No. 1 Semi-Tropic, Kern Co.	29-25-21	1,118	suspended
Howells Bros., No. 1 Round Mountain, Kern Co.	32-28-29	2,360	gr. sd. drilling
Semaphore Oil Co., No. 1 McVan Area, Kern Co.	14-27-27	1,000	sd. sh. drilling
Ohio Oil Co., No. 1 Buena Vista Lake, Kern Co.	31-31-26	7,284	sd. sh. drilling
Caravel Pet., No. 1 Edison, Kern Co.	19-30-30	1,498	suspended
Alta Oil Co., No. 1 Union Avenue, Kern Co.	6-30-28	6,457	prod. test
Mountain View Oil Co., No. 1 Mountain View, Kern Co.	25-30-28	1,826	sd. sh. drilling
Severns Drilling Co., No. 1 Mountain View, Kern Co.	24-30-28	5,842	sd. sh. drilling
Union Oil Co., No. 2 Mountain View, Kern Co.	23-30-28	mtl.	bldg. rig.
Hogan Pet. Co., No. 4 Mountain View, Kern Co.	29-30-29	4,902	sd. sh. drilling
Labadie, E. L., No. 1 Mountain View, Kern Co.	29-30-29	5,888	abandoning
Standard, No. 1 Mountain View, Kern Co.	19-30-29	5,631	oil & gas
Commanche Oil Co., No. 1 Commanche, Kern Co.	15-32-29	3,197	hd. sd. drilling
Badger Oil Co., No. 1 Wheeler Ridge, Kern Co.	31-11-19	5,980	suspended
Russ Oil Synd., No. 1 Kingsburg, Fresno Co.	28-12-11	4,004	suspended
Bergman, Harry, No. 1 Kingsburg, Fresno Co.	12-12-11	5,561	sd. sh. drilling
Graham & Loftus, No. 1 Raisin City, Fresno Co.	20-15-18	5,906	suspended
Emerich Oil Co., No. 1 Mendota, Fresno Co.	35-13-13	4,575	suspended
Western Gulf, No. 1 S.P., Fresno Co.	15-17-15	8,153	hd. sh. drilling
Hogan Pet. Co., No. 1 Joaquin Ridge, Fresno Co.	28-20-16	6,605	suspended
Kent & McDonald, No. 1 Carrizo Plains, San Luis Obispo	3-22-22	3,830	suspended
Farrel Pet., Well No. 1, San Luis Obispo Co.	18-31-12	1,095	suspended
Commonwealth Consd. Gas Co., No. 1 Tulare Lake, Kings	21-22-20	1,512	prod. test
Armadillo Oil Co., No. 1 Tulare Lake, Kings Co.	32-22-20	1,316	prod. test
Tulare Basin Oil Co., No. 1 Tulare Lake, Kings Co.	2-23-19	1,192	cemented
Tulare Basin Oil Co., No. 2 Tulare Lake, Kings Co.	2-23-19	1,200	suspended
Douglas, J. M., Well No. 1, Monterey Co.	36-22- 9	3,286	br. sh. drilling
Oakdale Oil Co., No. 1 Oakdale, Stanislaus Co.	5- 2-10	4,760	hd. sd. drilling
Pacific Northern Oil Co., No. 1 Guinda, Yolo Co.	23-12- 3	6,760	suspended
Buttes Oilfields Co., No. 1 Marysville, Sutter Co.	35-16- 1	2,731	gas—shut in
Buttes Oilfields Co., No. 2 Marysville, Sutter Co.	35-16- 1	4,320	suspended
Milham Exploration Co., No. 1 Tracy, San Joaquin Co.	5- 4- 5	3,720	hd. sh. drilling
Orland Oil Synd., No. 1 Orland, Tehama Co.	31-23- 3	3,790	suspended
Mid-Valley Oil Co., No. 1 Orland, Tehama Co.	14-24- 3	....	location
Tehama Pet., No. 1 Murdock, Glenn Co.	10-22- 5	620	suspended
Pure Oil Co., No. 1 Madera, Madera Co.	7-10-14	rig	rigging up.

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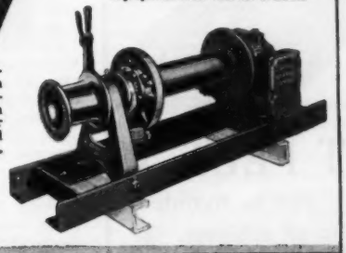

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to determine the probable production. Those familiar with progressive deep zone development in Los Angeles Basin fields do not doubt Pacific Western will ultimately prove additional zones in the Inglewood Field. Every indication supports the theoretical existence of additional horizons.

Montebello

Fullerton Oil Co., after negotiations extending over several months, has finally concluded a deal with the McGinley Oil Co. for the latter's 100 acres on which have been completed about 20 wells in the upper horizon. The interest in this lease is not because of present production but rather because the property has deep zone possibilities and consequently has greatly enhanced in value since discovery of lower zone production by Universal Consolidated several months ago. Fullerton Oil Co. is a very progressive concern and since it has always strictly adhered to curtailment regulations operators in the Montebello Field are pleased with its acquisition. Fullerton Oil Co. has already taken possession of the property and will start two deep tests within 15 days. The deal involved a cash bonus of $475,000 and provides for payment of a one-sixth royalty. The McGinley lease is a rather long narrow strip which should provide suitable locations for a number of deep zone wells if the lower horizon is as extensive as believed.

Universal Consolidated, subsidiary of Richfield Oil Co., has suspended drilling on two of its deep tests in the extreme eastern end of the field following failure to pick up the deep Cruz zone and has re-entered the deep zone discovery well and is deepening it in the hope of definitely determining what lies ahead. Standard is working on six projected deep zone completions in this field and is building rig for another. Texas Co. has three deep wells under way on the Baldwin, Barry and Prugh leases. Union is sitting tight as it knows operators will not be allowed to produce indiscriminately. Operators in this field have not submitted a unanimous drilling program. Until the petroleum administrator approves a development program operators will not be allowed to produce. It is possible some of the wells now under way will be allowed to produce upon completion but they must make up the excess at a later date. In the meantime, Union is getting the benefit of pioneering work. Wilshire's deep test in the Potrero Field has reached 6,450 feet without encouraging indications of deep production. Associated Oil Co. has filed abandonment notices on Nos. 1 and 2 on the Prairie lease in this field.

Eleven Completions in the Eastern Fields; Increased Activity in All Sections

By STAFF CORRESPONDENT

PITTSBURGH, Pa., May 7. — There were 11 completions in the lower eastern fields during the week, eight of which were producers with an initial production of 75 bbls. Three were gas wells. There were five dry holes. There is increased activity in all fields. Southeast Ohio had the majority of the completions.

SOUTHEAST OHIO

In Athens County, A. D. Townsend and others completed a test on the A. D. Townsend farm near Jerseyville in Section 17, Lodi Township. It was drilled in the Second Grit at 1,688 feet and is gauging 300,000 feet a day.

In Columbiana County, in NE Section 28, Knox Township, T. R. Philips & Co. completed a second test on the S. L. Hahlen farm in the Berea sand at 730 feet. It produced 8 bbls. the first day natural, and 10 bbls. the first day after shot.

In Hocking County, Preston Oil Co. completed No. 1,540 on the Sunday Creek Coal Co. in SE Section 11, Ward Township. It was drilled in the Clinton sand at a depth of 3,575 feet and produced 15 bbls. the first day after shot.

In Jefferson County, Edward C. Collins and others completed drilling a second test on the Steubenville & Wheeling Tractor Co. property in Section 28, Steubenville Township. It found the sand badly broken up in the Berea sand at a depth of 1,600 feet and was abandoned as dry.

In Licking County, there were two completions. In Perry Township, L. W. Rutledge, trustee, drilled a second test on the Walter Hoyt farm in Section 17 in the Berea sand and it produced 10 bbls. the first day after shot. On Lot 2, Mary Ann Township, C. R. Settles completed a test on the O. B. Evans farm in the Berea sand which produced 4 bbls. the first day after shot. It is estimated as a 1½-bbl. pumper.

In Noble County, B. E. King drilled No. 9 on the L. R. Crum farm in NW Section 7, Enoch Township. It had a very light show of oil in the shallow Buell Run sand at 254 feet which was not sufficient to put to pumping.

In Perry County, J. W. Walsmith and others completed a second test on the Samuel Redfern farm, SE Section 21, Harrison Township. It is gauging 100,000 feet a day from the Berea sand at 1,186 feet.

In Washington County, Harris Drilling Co. and E. J. Mildren abandoned their deep test, No. 3 on the David Pool farm, NE SW Section 11, Grandview Township, as a dry hole. It had been drilled in the Warren sand at 3,250 feet and shot.

WEST VIRGINIA

There were four producers completed in West Virginia and a considerable amount of reconditioning work done. In Doddridge County, Hope Construction & Refining Co. completed No. 3,568 on the Harvey Smith farm in West Union Township in the Big Lime at 2,002 feet. It is showing for 3 bbls. a day, natural.

In Ritchie County, there were two producers, one making a fair showing. In Clay district, about 1½ miles north of the Lost Run Pool, J. C. Smith and others completed a test on the L. H. Hanlon farm in the Injun sand at about 1,900 feet. It is showing for about 10 bbls. a day natural which is expected to improve with shot. In Grant district the Queen Oil & Gas Co. completed No. 3 on the Sarah McKinney farm in the Maxon sand at 1,832 feet and has a showing for 3 bbls. a day.

In Roane County, Henderson Oil Co. completed a second test on the F. H. Bee, Jr., farm in Curtis district in the Salt sand showing for 20 bbls. a day. In this county, South Penn Oil Co. is continuing work in reconditioning wells on the O. D. Stockley lease with good results.

Gas Wells

There was only one gas well completed in West Virginia. In Marshall County, Manufacturers Light & Heat Co. completed No. 3,474 on the August Wend farm in Liberty district in the Fifty-foot sand at 3,350 feet, showing for a small gas well.

In Ritchie County M. A. D. Broadwater drilled a test on his own property in Grant district through the Berea sand and abandoned it as a dry hole.

Drilling in West Virginia

There is increased activity in many sections of West Virginia. In Boone County, Godfrey L. Cabot, Inc., has started drilling on the Sidney White farm and is rigging up on the Henry Keedle farm. Pond Fork Oil & Gas Co. is down 300 feet in No. 17 on the Cole and Crane lease. All are in Washington district. In Sherman district, Pure Oil Co. is drilling at 2,167 feet in No. 65 on the Federal Coal Co. tract and 811 feet in No. 66, same lease. Godfrey L. Cabot, Inc., has reached 835 feet in No. 53 on his lease on the Federal Coal Co. property.

In Cabell County there is no new work reported but the following wells are drilling: In Guyandotte district, the May Gas Co. is drilling at 1,230 feet on the G. I. Neal farm; Graham Gas Co. is down 1,695 feet on the Frank Marchetti farm; Guyan Valley Gas Co. has reached 1,200 feet on the Colored Children's Home; and United Fuel Gas Co. is rigging up on the J. W. Starkey farm. In McComas district, Madison Gas Co. is down 1,100 feet on the Wade H. Holton farm; West Virginia Gas Co. is drilling at 1,700 feet on the George Pruett farm and 820 feet on the John J. Porter farm.

In Calhoun County, L. P. Bickel has completed a rig for No. 15 on the Martha Stump heirs farm, Sherman district. R. Fowler and others are rigging up for a second test on the Fred Stump farm. F. F. McIntosh has reached 1,560 feet in No. 5 on the O. S. Bennett farm. In Sheridan district, W. H. Bickel has part of the material on the ground on the L. F. Norman farm. In Washington district, Eastern States Gas Co. has a permit on the Martha A. Boggs farm. Kenny and Phillips are drilling deeper at 1,800 feet in No. 1 on the J. C. Carpenter farm. Everett Starcher has a rig completed on the Curtis and Ella May farm. In Center district, Starcher and Richards have part of the material on the James Wilson farm.

In Clay County, on the waters of Big Sandy, South Penn Oil Co. has completed a rig for No. 107 on the O. D. Stockley farm in Henry district. In Pleasant district, Godfrey L. Cabot, Inc., is drilling No. 9 on the Hill-Long lease at 2,651 feet.

In Gilmer County, Mountain Iron & Supply Co. has started drilling No. 3 on the A. H. Stump farm, Center district. Hope Construction & Refining Co. has started drilling No. 3,569 on the Mary A. Stump farm, same district. Godfrey L. Cabot, Inc., is getting ready for two wells in this district.

In Kanawha County, Godfrey L. Cabot, Inc., has started drilling No. 43 on the A. D. Huntington lease in Cabin Creek district and is building a rig for No. 44 and has three additional locations prepared. In Malden district, this operator is drilling at 1,255 feet No. 6 on the Campbells Creek Coal Co. lease.

In Monongalia County, on Miracle Run in Battelle district, Harry L. Tennant has completed a rig for No. 5 on the Wise-Tennant lease. In Marshall County, Manufacturers Light & Heat Co. has reached 2,900 feet in No. 3,512 on the James Reid farm in Liberty district and has completed a rig for No. 3,513 on the J. C. Clouster farm. In this district, Guy B. and A. B. Patterson are drilling at 2,415 feet in No. 3 on the C. and A. B. Williams farm.

In Ritchie County, King Knob Oil & Gas Co. has completed a rig for No. 5 on the Payton Lingler farm on Lamb Run in Murphy district. In Grant district, John Leeton and others have started drilling on the David Gray heirs farm. Petroleum Producing Co. is down 325 feet on the Jennie Carroll farm. Doctor Conley is drilling at 1,670 feet on the T. E. and A. F. Dye farm.

In Lost Run Pool, Clay district, Ritchie County, Glen F. McBurney and others have reached 1,875 feet on the Harrison Ball farm. Mahaney and Lucas are down 1,010 feet in No. 3 on the Corlie Ball farm. Richards Farm Oil Co. is drilling at 1,575 feet in No. 4 on the Catherine Ball farm. Boehm & Strickler Oil Co. is at 725 feet in No. 6 on the Boehm & Strickler farm. Howard Robinson is drilling at 500 feet on the William Flanigan farm. Locke-Simonton are down 800 feet on the W. J. Wince farm.

In Roane County, United Fuel Gas Co. has made a location for No. 4,392 on the S. C. Ross farm in Geary district. In Spencer district, O. G. Epling

(Continued on Page 192)

Reported Oil Strike in Old Florence Field, Colo.; Cut Bank Field Is Extended Mile to Westward

By TOLBERT R. INGRAM
Staff Correspondent, Rocky Mountain Area

DENVER, Colo., May 7.—The General Crude Oil Co.'s No. 1 Meyers, 4 miles north of the Jal Pool in New Mexico, flowed 225 bbls. in the last of several one-hour tests. Texas Co.'s No. 1 Lea, which opens a new pool 3 miles north of the Lea Field, is waiting for pipe line connections before testing. One new location was released in the Hobbs Pool. Grayburg Oil Co.'s No. 5 Burch, in Eddy County, has 300 feet of oil in the hole at 3,047 feet.

Reported oil strike in the Pennsylvanian formation near the old Florence Field in Colorado is attracting attention, although accounts differ. Texas Co. is resuming operations in the Tow Creek Field in Routt County, where it has made a new location.

Two wells in the Frannie Field in Wyoming are being completed as producers. The W. O. Taylor test in a fault block in the Byron district, is to be carried to the Madison lime with rotary equipment. Kinney-Coastal Oil Co. is renewing operations in the Pilot Butte Field.

Dunstall's No. 1 Kennerly, which extends the Cut Bank Field in Montana more than a mile west, showed an improvement on the pump and made 92 bbls. initial. Two wells were completed, Texas Co.'s No. 2 Purdy making 118 bbls. and Santa Rita Oil & Gas Co.'s No. 2 Wetstone swabbed 75 bbls. One new location was released in the Cut Bank Field and another in the South Cut Bank area.

NEW MEXICO

Lea County

General Crude Oil Co.'s No. 1 Meyers, NE cor. SE Section 22-24-36, in the Cooper area in southeastern Lea County, a gas well which came in as an oil producer upon being deepened, indicated on several short gauges it will come up to earlier expectations when it was estimated it might make as high as 5,000 bbls. a day initial. The well is 4 miles north of the most northerly producer in the Jal Pool and is generally considered an extension of that field. It was completed for 50,000,000 feet of gas per day in 1929 at 3,438 feet, total depth. It has been deepened in the past few weeks to 3,512 feet. The 7-inch is cemented at 3,498 feet. It was given a one-hour test through a three-fourths inch choke and made 70 bbls. of fluid of which 10 per cent was water. The results were the same for the second hour. Then it was tested for an hour through a 2-inch choke and made 85 bbls., of which 13 per cent was water. The fourth hour the flow increased to 107 bbls. Then it was tested through a 2-inch choke on the pipe and a three-fourths-inch choke on the tubing and made 198 bbls. the first hour and 225 bbls. the second hour, with 100 pounds back pressure on the tubing. The gas is estimated at 3,000,000 feet per day. After the last one-hour test it was shut in for pipe line connections. This well is several miles from any other well except the same firm's No. 1 Cushing, SW SE NW Section 23-24-36, one-third mile to the east, which was completed as a gasser in 1929. Last named is rigging up rotary to drill deeper to the oil horizon from 3,205 feet, old total depth.

Texas Co.'s No. 2 Moberly, C NW SE Section 8-26-37, in the southeastern part of the Jal Pool, did not show up very favorably when efforts were made to flow it with gas lift. It made 139 bbls. of fluid in 19 hours, of which 87 per cent was basic sediment and water. Stanolind Oil & Gas Co.'s No. 29-B Farnsworth, C SW SW Section 7-26-37, set 8⅝-inch at 2,830 feet with 400 sacks, and is waiting. Repollo Oil Co.'s No. 1 Stephens, SW cor. NE Section 13-25-36, spudded April 23 and is drilling at 225 feet in the red beds.

Continental Oil Co.'s No. 2-B-13 Sholes, C NW NW Section 13-25-36, is drilling at 2,980 feet in lime. Barnsdall Oil Corp.'s No. 1 Forrest, NE NW SW Section 24-25-36, is rigigng up machine to drill deeper from 3,220 feet, at which depth it flowed 40 bbls. of oil, emulsion and acid and then went dead.

Lea Area

Texas Co.'s No. 1 J. S. Lea, SW cor. NW Section 14-20-34, 3 miles north of the Lynch wells in the Lea Pool, which flowed by heads through 450 feet of cavings while running pipe, has not yet been tested. Total depth is 3,560 feet, in sand. The 6¼-inch was cemented at 3,535 feet with 75 sacks and 12½-inch pipe was pulled. Pipe line to the well is being laid and as soon as it is finished and tanks put up, the plug will be drilled and the well tested. Texas Co.'s No. 2-B Lynch, C SE SW Section 27-20-34, is standing at 3,805 feet, total depth, after plugging back to 3,750 feet, and will treat with acid. General Crude Oil Co.'s No. 4-B State, C Lot 10, Section 2-21-33, is drilling deeper from 3,763 feet, where it was completed last year for 300 bbls. initial.

Hobbs Area

One new location was released in the Hobbs Pool in Gypsy Oil Co.'s No. 8 West Grimes, NW SW NW Section 32-18-38, which has cellar and pits completed. Empire Gas & Fuel Co.'s No. 4 Fowler, NE SE NE Section 31-18-38, which gauged 4,925 bbls. initial through casing before being treated with acid, was treated with 1,000 gallons and is on production, but no gauge has been taken since it was treated. Noble Brothers' No. 2 Shell-State, a south offset to No. 1 Shell-State, is still a location. The footage is 1,980 feet from the south line and 2,310 feet from the west line.

Eunice Area

Continental Oil Co.'s No. 8-A-1 A. E. Meyers, C NE SW Section 8-21-36, is waiting after cementing 7-inch at 3,690 feet with 400 sacks, and its No. 17-A-3 Meyers, C SW NW Section 17-21-36, is waiting for tools after completing derrick. Tide Water Oil Co.'s No. 2 Coleman, C NW NE Section 17-21-36, is drilling plug after cementing 12½-inch at 320 feet. Gypsy Oil Co.'s No. 1 State, C SW SE Section 8-21-36, is shut down for tools after completing rig, and Atlantic Oil Producing Co.'s No. 2-B State, C NE SE Section 8-21-36, is waiting on water wells.

Eddy County

Guess & McIntosh's No. 1 State, NW cor. Section 8-26-28, Red Bluff district, southern Eddy County, is rigged and ready to spud with machine. Stovall & Marshall's No. 1 McIlvain, C SE NE Section 5-25-27, Black River district, is drilling at 1,250 feet in anhydrite and lime. R. D. Compton's No. 2 Pitcher, NW NE Section 8-18-27, Artesia area, is drilling at 950 feet, and his No. 6 Brainard, SE cor. Section 5-18-27, is drilling at 1,060 feet. Grayburg Oil Co.'s No. 5 Burch, C SW NE Section 19-17-30, Maljamar area, is drilling at 3,062 feet with 300 feet of oil in the hole from 3,042-47 feet.

San Miguel County

Cabra Springs Oil & Gas Co.'s No. 1, C NE NE Section 22-12-22, Pinon Mesa, is drilling at 2,910 feet in red sandy shale and arkosic material below the Glorietta sand.

San Juan County

Continental Oil Co.'s No. 33, NE SW NE Section 2-29-19, Rattlesnake Field, had a small show of oil and gas at 845-49 feet. Jack Amenda and others' No. 1, NE SW Section 25-30-12w, Aztec district, is drilling at 650 feet and had a show of oil and gas at 570 feet, followed by sulphur water at 648 feet. Aztec Oil Producers, Inc.'s No. 2, C SE SE Section 28-30-11w, set the 8¼-inch at 900 feet and is drilling at 980 feet.

COLORADO

Fremont County

Two versions are given of a reported oil strike north of the old Florence Field in Waterville Oil Co.'s No. 1 State, SE cor. NW Section 16-18s-69, on the Phantom Canon road 7 miles north of Florence. Scout reports are to the effect the well is shut down at 2,800 feet and no oil is showing. The well is on state land. C. J. Frederickson, president of the company, who has persisted for years in his efforts to locate the source of the oil produced in the Florence Field, in an official report to the State Land Board, says that on April 18 the gas pressure became so strong the driller pulled the tools and ran the bailer to see what had happened. He states that the bailer came up full of high grade live oil and sand and the well was immediately shut down until the hole could be cased. The hole is open below 2,335 feet where 6⅝-inch was set. Officials of the land board express their confidence in Frederickson and accept his report as anthentic.

A strike at this location in the Pennsylvanian formation would be of great importance. The Florence Field has produced more than 12,000,000 bbls. of oil since it was discovered in 1862. The oil comes from the Pierre shale. Every barrel of it was pumped, there being no flowing wells, and no water is encountered. None of the oil has come from a sand formation, the underlying Dakota being barren. Some of the wells have produced continually for more than 30 years. Wildcats have been drilled in many directions trying to find the source of this oil. In more recent years the opinion has predominated that the oil originates in the shale. The Waterville well is 7 miles north of the Florence Field and immediately north of an arc-shaped hogback that dips toward the south. The formations rise very rapidly to the north and the well starts in the

Important New Test in Far South Section of the South Turner Valley Field

By VICTOR LAURISTON
Staff Correspondent, Canadian Fields

CHATHAM, Ontario, May 5.—An important new test of a potential southerly extension of the South Turner Valley Field will be started this spring by Okalta Oils, Ltd., of Calgary in LSD 14, Section 16-18-2w5. Okalta's No. 6 will start as soon as surface rights are secured. The company will likely do its own drilling with cable tools. Section 16 is due south of Section 21-18-2w5, where Highwood-Sarcee Oils' No. 1 got light crude production in the Dalhousie; and is in line with Section 28-18-2w5. The acreage is part of a lease secured by W. S. Herron in 1912 and later turned over by him to Okalta Oils, Ltd., when the company was organized. The Herron leases covered W half Section 16-18-2w5, Sections 20-18-2w5 and 30-18-2w5 and Section 6-19-2w5. Arrangements may be made with other interests for the testing of part of this acreage.

In Section 28-18-2w5, Mar Jon Oil Co.'s No. 2 Kindersley, LSD 10, is gradually increasing its crude naphtha recovery from the lime. Production has been retarded by drilling water getting into the sand, but recovery has increased from 20 to 40 bbls. a day and the well may become a good producer.

Pacalta Oils' No. 1, LSD 7, same section, is below 4,970 feet, and should get the lime a little below 5,000 feet. Publix Oil & Gas Co.'s No. 1, LSD 8, is below 2,550 feet, and indications are that the Blairmore will be reached at a high point. Spooner Oils' No. 5 Anaconda, LSD 1, is at 4,670 feet sidetracking lost tools. Century Royalties' No. 1, LSD 14, is resuming at 3,500 feet after repairs. Director Royalties' No. 1, LSD 16, rotary test, is below 3,565 feet.

British Dominion Oil & Development Corp.'s No. 4, LSD 6, same section, is making new hole at 500 feet. Richfield Royalties' No. 1, LSD 5, is around 1,500 feet. Carleton Royalties' No. 1, LSD 2, will likely spud in this month in the southeast portion of Section 28, offsetting Highwood-Sarcee's No. 1 to the northwest.

On the east side of the structure, the Northwest Co.'s No. 1 Calgary & Edmonton-Longview, LSD 5, Section 27-18-2w5, is in top of the lime at 5,620 feet, 30 feet in the Madison. The test proves structure to the east.

Far South Tests

South of the proven area, Highwood-Sarcee Oils' No. 1, LSD 16, Section 21-18-2w5, got the Madison at 5,352 feet and cemented casing at 5,360 feet. Farther west, Myers & Wright's No. 1, LSD

(Continued on Page 189)

red beds, which lie at a depth of several thousand feet in the Florence Field. The red beds are supposed to rest on the granite in the Pueblo district to the east, but this well and a well drilled several years ago by Mutual Oil Development Co. 6 miles northwest, encountered the Pennsylvanian. The Mutual well was drilled in the SW SW Section 34-17-70 and is supposed to have encountered the red beds at 1,466 feet. It had a number of small shows of oil and gas but at 2,698-2,788 feet ran into a flow of water, the well making 1,400 bbls. an hour, which prevented further exploration and the hole was plugged and abandoned.

The only active operation in the Florence Field is John Milner and others' No. 1, SW SE SE Section 30-18-69, which is drilling at 2,400 feet in gray shale.

Routt County

Texas Co. is resuming operations in the Tow Creek Field, a shale area, and has made a location for its No. 1 Carstarphen, NW NE NW Section 5-6n-86, in the northern part of the pool.

Moffat County

Stanolind Oil & Gas Co.'s No. 32 Parkinson, Lot 6, Section 23-4n-92, Iles Dome, cemented 8⅝-inch in top of the Sundance at 3,331 feet and is drilling out plug. The cores showed good saturation and it will be an early completion. Same company's No. 6 Parkinson, Lot 37, SW Section 23-4n-92, is waiting for rig from No. 32 Parkinson. Mountain Fuel Supply Co.'s No. 2-B Florence Wilson, C SE SW Section 15-12-100, Hiawatha district, is coring at 2,312 feet.

Grand County

Colorado Oil Refining Co.'s No. 1 Linke, C SW SW Section 13-1n-77, Granby district, is rigged and ready to spud. Interstate Oil & Refining Co.'s No. 1 Hinman, NE SE NW Section 11-2n-81, Dirt Creek, is shut down at 1,797 (cor.) feet for 6¼-inch pipe. The 8¼-inch parted and it was necessary to case the hole to stop caving. No water has been encountered.

Larimer County

Eastman & Deininger's No. 1 Cement, NE SE NW Section 30-5n-69, Loveland district, is shut down temporarily at 465 feet. This well is running 20 feet higher than the highest test drilled in the district, several of which showed a thin saturated sand below the present horizon in the No. 1 Cement.

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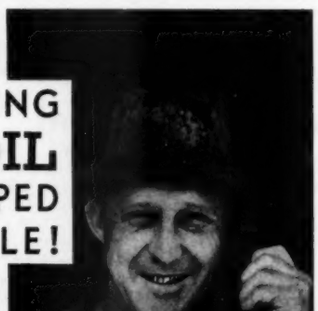

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WYOMING

Park County

Two wells in the Frannie Field are near completions. Frannie Oil Co.'s No. 2 Northern Pacific, SE SW SE Section 23-58-98, is coring at 3,231 feet and showing heavy saturation. Stanolind Oil & Gas Co.'s No. 21 Rosenberg, NE SW NE Section 26-58-98, at a total depth of 3,297 feet, has 1,250 feet of oil in the hole from the Embar at 3,215-69 feet and in a two-hour bailing test, the column was not lowered any. The 8⅝-inch is at 3,250 feet.

Big Horn County

W. O. Taylor and others' No. 1 Hoskins, Lot 5 (SE SE) Section 25-56-97, Byron district, is preparing to resume at 2,855 feet. A deal has been made with Sidney H. Keoughan to move in a rotary, pull the 10-inch and drill with a 11-inch bit to the top of the Madison. This well is on an island in the Shoshone River. At 2,376 feet it showed for 500,000 feet of gas and 6 bbls. per day of 56 gravity oil.

Hot Springs County

California Exploration Co.'s No. 1, NE SE NE Section 12-44-97, Waugh structure, which is headed for the Embar-Tensleep at 4,100 feet, has resumed after spudding to 100 feet and shutting down in March.

Fremont County

Kinney-Coastal Oil Co.'s No. 1 Chatterton-Weeks, C SW NE Section 22-3n-1w, Pilot Butte Field, which was temporarily completed as a gas well in the Muddy last year after plugging back from 3,790 feet to 3,680 feet, has resumed. It has drilled out plug and is making new hole with the Lakota at around 4,000 feet as its objective. The top of the Muddy was at 3,560 feet. The gas in that formation built up a rock pressure of 1,350 pounds. The company has another big gas well in the field which is shut in.

Sweetwater County

Mountain Fuel Supply Co.'s No. 2 Union Pacific, C SW SE Section 11-19-104, North Baxter Basin, is drilling at 2,975 feet. It is headed for the Sundance at 3,300 feet.

Carbon County

Earl W. Reeder, Inc.'s No. 1 Union Pacific, C SW SW Section 19-20-83, Overland Dome, an important wildcat, has encountered more trouble and is fishing for the 3-inch bit below 4,455 feet. It is planned to install a special bradenhead to produce gas and possibly oil from the Wall Creek between the 8¼ and 4¾-inch casings. The 6¼-inch is parted at 3,900 feet. The 8¼-inch is at 2,810 feet and the 4¾-inch at 4,455 feet. At 4,429 feet the oil was standing within 500 feet of the top of the hole. Producers & Refiners Corp.'s No. 4 Wertz, SW cor. SE Section 7-26-89, Wertz Dome, is drilling out cement at 2,655-2,700 feet after plugging back from 3,541 feet to straighten crooked hole. The Ohio Oil Co.'s No. 1 Morris, C NW SE Section 6-20-77, Diamond Dome, a wildcat, is moving in materials.

Albany County

Ohio Oil Co.'s No. 1 Chappell, C SE NW Section 28-21-76, near the town of Rock River, is rigged and ready to spud.

Natrona County

Midway Oil Corp.'s No. 1 Boyer, SW NE NE Section 23-35-79, Midway Dome, is running rods and tubing at 5,190 feet, total depth, to test oil show in the second Wall Creek.

Weston County

West Osage Oil Co.'s No. 3, SE NE Section 15-46-64, Osage Field, is drilling at 1,800 feet, and C. L. Nichol's No. 4, SE cor. NW Section 8-46-63, skidded rig and is drilling at 100 feet in new hole. Albert Jones' No. 6 Bock, NW SE Section 21-46-63, is drilling at 400 feet, and Homestake-Osage Oil Co.'s No. 4, NW SE Section 13-46-64, is drilling at 400 feet. Karl Cundy's No. 8, SE NW NE Section 31-46-63, is rigging up, and Chadron-Osage Oil Co.'s No. 24, SW NW SE Section 14-46-64, is drilling at 1,600 feet.

Elkhorn Refining Co. (Jack Eaton and Joe Dornacher) is installing machinery for a compression casinghead gasoline plant to operate in conjunction with their refinery in SE Section 18-46-63.

MONTANA

Glacier County

Dunstall and others' No. 1 Kennerly, E NE NW Section 22-34-6w, in the Blackfeet Indian Reservation, more than a mile west of the nearest producer in the Cut Bank Field, proved to be a much better well than its performance when first drilled in indicated, and pumped 92 bbls. initial. It marks an extension of the proven area in the northwestern part of the field. Its total depth is 3,037 feet and it had 450 feet of oil in the hole from the pay at 2,965-92 feet.

Two completions and one new location in the field were reported. Texas Co.'s No. 2 Purdy, C NE SW Section 35-35-6w, pumped 118 bbls. initial and settled to 63 bbls. daily. Total depth is 2,888 feet and the pay was at 2,844-84 feet. Santa Rita Oil & Gas Co.'s No. 2 Whetstone, C Lot 4 (SE SE) Section 22-35-6w, swabbed 75 bbls. in 12 hours from the pay at 2,850-93 feet. Total depth is 2,896 feet. The new location is Texas Co.'s No. 1 Mabel Morrison, NE SE SE Section 22-35-6w.

Dakota-Montana Oil Co.'s No. 1 Gilham, C Lot 4, (NW NW) Section 3-34-6w, is bottomed at 2,930 feet and drilling in with 1,800 feet of oil in the hole.

A new location in the South Cut Bank area is Hannah-Porter Co.'s No. 1 Zabel, C SE NE Section 30-32-4w.

Bakke-Lund and others' No. 1 Anderson, SW cor. NW Section 26-35-6w, is rigging up, and the Indian Oil Co.'s No. 1 Clark, C SE SE Section 4-34-6w, is rigging up. Montana Headlight Oil Co.'s No. 2 Williams, C NE NE Section 11-34-6w, is fishing for casing at 2,795 feet.

Montana Power Gas Co.'s No. 1 Neill, C NE Section 20-33-5w, is drilling at 2,580 feet, and its No. 1 People's Unit, near C W half E half, Section 14-33-5w, is drilling at 410 feet. Same company's No. 3 Seeba, SE cor. NW Section 2-34-6w, is drilling at 930 feet.

Nyhagen-Bell's No. 2 Anderson, NW cor. SW Section 26-35-6w, is drilling at 1,660 feet, and Nadeau Brothers' No. 2 Van de Mar, E SW NW Section 35-35-6w, is drilling at 2,775 feet. Par Oil Co.'s No. 3 Haines, SW cor. Section 2-34-6w, is rigging up.

Producers Development Syndicate's No. 1 Eniarson, SW NW NW Section 29-32-4w, South Cut Bank area, is fishing for bailer and string of tools at 2,679 feet. It found the first Cut Bank sand, topped at 2,631 feet, dry.

Santa Rita Oil & Gas Co.'s No. 3 Cardwell, C Lot 2, Section 15-35-6w, is drilling at 2,385 feet, and its No. 1 Hardy, C Lot 5, Section 27-35-6w, is drilling at 2,350 feet.

R. C. Tarrant's No. 3 Emma Britton, C NE SW Section 12-34-6w, is drilling at 2,480 feet, and his No. 1 Getty, C NE SE Section 2-34-6w, is drilling at 1,330 feet. Tarrant's No. 1 Jones, C SW SE Section 31-34-5w, is rigging up.

Texas Co.'s No. 1 Antrim, C Lot 4, Section 27-35-6w, is drilling in at 2,933 feet after setting 7-inch at 2,896 feet, and its No. 2 Antrim, C Lot 1, Section 34-35-6w, is drilling at 2,119 feet. Same company's No. 1 fee, Lot 7, Section 15-35-6w, is drilling out plug after cementing the 7-inch at 2,827 feet, and its No. 2 fee, Lot 8, Section 15-35-6w, is drilling at 465 feet. Texas Co.'s No. 2 Hinkle, near C W half, W half, NW Section 2-34-6w, cemented the 7-inch at 2,838 feet and is waiting. Same company's No. 3 Hinkle, SW cor. SE Section 2-34-6w, is rigging up, and its No. 1 Long, W NW SW Section 23-35-6w, is drilling at 2,425 feet. Texas Co.'s No. 1 Schlag, C SW SW Section 26-35-6w, is cementing the 10-inch at 350 feet, and its No. 2 Yunck, W SW SW Section 14-35-6w, cemented 7-inch at 2,833 feet and is pulling the 10-inch.

Canadian Fields

(Continued from Page 187)

14, same section, is installing machinery. Oliver Syndicate's No. 1, LSD 3, in the south part of the section, is reported ready to spud. Union Drilling Co.'s No. 1, LSD 8, is working on casing at 2,758 feet.

In Central Turner Valley, Okalta Oils' No. 4, LSD 8, Section 1-20-3w5, is at 3,415 feet. The first light crude pay, the McDougall-Segur sand, is expected between 3,600 and 3,700 feet.

Further Royalite Deals

Directors of Okalta Oils, Ltd., have arranged for the taking over by Royalite Oil Co. of certain Okalta properties and production in Central Turner Valley. The deal includes Okalta's Nos. 1, 2 and 3, in Section 1-20-3w5, together with 210 acres of leases. Okalta Oils will retain its other acreage together with actual and potential light crude production from the Central Turner Valley acreage included in the transfer. The deal does not include Okalta's No. 4, LSD 8, Section 1-20-3w5, which now is drilling with the light crude horizons above the line as objectives.

It is unofficially reported a similar deal is being negotiated with McLeod Oil Co. which has five deep wells and some acreage in LSDs 15 and 16, Section 1-20-3w5.

Turner Valley Producers

Official figures of production of individual Turner Valley companies for March show that Royalite Oil Co. with 43,656 bbls. accounted for a large part of the month's total of 116,328 bbls. for the field. Miracle Oils, Ltd., ranked second with 7,880 bbls. and Sterling Royalties' No. 1 delivered 7,389 bbls; Freehold-Mar Jon's No. 1, 6,118 bbls.; Merland Oil Co.'s No. 1, 6,016 bbls., and Becker Syndicate's No. 2 Anaconda, 5,845 bbls.

In the Red Coulee Field, O'Neill Syndicate delivered 497 bbls. in March, and Vanalta Oils 1,445 bbls. Hudson's Bay Oil & Gas Co.'s No. 1 Keho, in the Keho Lake area, produced 33 bbls.

In the Wainwright Field, Sasko-Wainwright Oil & Gas Co.'s No. 1 recorded a production of 301 bbls., and Gold Standard Oils had deliveries of 124 bbls., estimated.

Aldersyde Flurry

Considerable excitement was caused by reports oil had been struck in Ranchmen's Gas & Oil Co.'s No. 1 in LSD 16, Section 13-20-29w4 on the Aldersyde structure, east of Turner Valley. There is apparently no foundation for the reports. Ranchmen's No. 1 has been inactive since March 28, at 6,200 feet. Preparations are being made to drill deeper. The log gives small oil shows at 2,780 and 3,490 feet. At 4,300 feet the drill was in the Benton and the Madison lime appears to be beyond reach at this point, though there are chances of production in some of the upper horizons. Considerable acreage has been leased in the High River-Aldersyde area, and bids aggregating $5,017 were made for 4,950 acres.

On the Birch Ridge structure west of Calgary, Elbow Oils' No. 1, LSD 11, Section 35-22-5w5, got the Dalhousie sand at 4,350 feet and is drilling below 4,370 feet, with prospects of getting the Madison lime a little deeper than in Turner Valley.

Tests in the Foothills

On the Pekisko Hills structure south of Turner Valley, Pekisko Hills Co.'s No. 1, LSD 6, Section 6-17-2w5, is reported drilling in the poker chip shales above the lime at 340 feet.

Banner Oils, Ltd., of Calgary is planning to complete No. 1 in LSD 6, Section 34-17-3w5, on the Sinclair structure north and west of Pekisko's No. 1 and about midway between that test and the Highwood-Sarcee well in South Turner Valley. No. 1 was started in 1929 and since has been standing at 617 feet. At this depth the drill had got through the Benton into the Blairmore formation, and was expected to get the Madison lime at about 1,500 feet. The hole will be completed with cable tools. Work will resume about the end of May.

In the forest reserve area west of Olds, Hunter Valley Oil Co.'s No. 1 McLaren, Township 31-10w5, is underreaming.

Border Fields

On the Twin River structure south of Lethbridge, the gas flow in Nordon-Roney's No. 2 Twin River, LSD 11, Section 2-2-20w4, is reported increasing and it is hoped to flow the oil.

In the Skiff Field, Devenish Petroleum's No. 5, LSD 4, Section 27-5-14w4, is rigging up.

North of Edmonton, Frontier Development's No. 1 Brosseau, LSD 8, Section 36-55-12w4, on the Duvernay structure, is reported below 923 feet.

Saskatchewan Test

In southern Saskatchewan, Pine River Petroleums' No. 1, LSD 8, Section 23-12-24w2, on the Dirt Hills structure southwest of Regina, is preparing to make new hole from 2,938 feet.

British Columbia Operations

In the Fraser Valley, British Columbia, Noble Francis Syndicate's No. 1 on Mrs. John McGachie's farm, south of New Westminster, is deepening in a formation which tests 95 per cent lime. The test, which previously encountered four gas shows between 135 and 820 feet, recently drilled into an additional flow and is going still deeper.

Announcement of the intention of the British Columbia government to assist in the development of oil and gas areas in the province has aroused interest in the potentialities of the Kamloops area, on the Thompson River north and east of the Fraser Valley proper, where it is claimed surface indications of oil and gas have been frequent. Outcrops of a black oil sand are reported on the old Vic ranch and at least one resident on the river bank has secured sufficient natural gas for domestic purposes.

Ontario

In the Dawn Field, Lambton County, Ontario, Union Gas Co.'s No. 74, Lot 24, Concession 8, Dawn Township, is reported to have got production in the Dawn sand with an initial flow approximating 2,000,000 feet a day.

In the Hockley Valley south of Collingwood, close to the boundary between Dufferin and Gray Counties, Hockley Valley Oil Co. is drilling a doodlebug test some 600 feet in the granite. It is below 2,500 feet.

In Raleigh Township, Kent County, east of the Raleigh-Tilbury East town line, C. H. S. Oil & Gas Co. has shot a well recently purchased from the Southern Ontario Gas Co. Officers of the company are: President, Charles H. Shell; vice president, C. C. Mack; secretary-treasurer, H. F. Van Dirsten; geologist, R. G. Barnum; associate geologist, Grant Rowe; directors, Dr. W. A. Elgie, Vincent Egan, U. G. Reaume. A shot production of 25 bbls. a day, with incidental gas production of 500,000 feet, was claimed, but the gas flow dropped to 350,000 feet or less. The company has 6,500 acres under lease and is reported arranging for the drilling of four additional tests. Gas production will be taken by the Southern Ontario Gas Co. Crude will be shipped in tank cars to Imperial Oil Refineries at Sarnia.

Royalite Meeting

Shareholders of Royalite Oil Co. held their annual meeting at Calgary when the following officers were re-elected: Chairman of board of directors, G. H. Smith; president, J. H. McLeod; vice president, Alexander Hanna; secretary-treasurer, T. E. Burns; directors, W. S. Herron, C. M. Moore. The company reported $431,013 profit on 1933 operations, paid dividends of $541,400 and had a surplus of $2,455,239. It was stated the company, having ample gas for its purposes, was not planning to do any additional drilling this year, unless new offset wells became necessary. As a result of the operation of the gasoline absorption plant, complete naphtha recovery was secured from wet gas.

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Completions Add 7,500 Barrels to Michigan; Increase in Prorated Runs Is Announced

By PAUL A. ELLIOTT
Staff Correspondent, Michigan Fields

MUSKEGON, Mich., May 7.—An increase in prorated oil runs from 5 to 7 per cent over the minimum exemption of 100 bbls. daily per well was announced last week for May by the Michigan producers proration committee despite the addition of about 7,500 bbls. of new daily oil production, including about 5,500 in nine new Porter Township wells and increases aggregating 2,000 bbls. in wells previously drilled into the pay sands.

In addition to the nine new completions in the Porter Pool, five of them in Section 21, two new gassers in the Broomfield area had an aggregate open flow of 7,250,000 feet and one dry hole in Mecosta County was finished, making a total of 12 completions for the week.

The state potential for May was estimated at 135,910 bbls. daily compared with 126,461 bbls. for April, an increase of nearly 10,000 bbls. Greater seasonal demands are expected to increase the average daily runs from 29,207 bbls. during April to 31,020 bbls., or within less than 300 bbls. of the State's maximum allowable of 31,300 bbls. under the code.

Rules on Potential Taking

New regulations changing the method of potential taking also were announced by James C. Graves, chairman of the proration committee, following several conferences with producers, officials of the Oil and Gas Association and other members of the committee. They are as follows:

1. Potential tests for flowing wells over 500 bbls. shall be made over a period of three consecutive hours and calculate the potential by multiplying the oil produced during the third hour by 24. Potential tests on pumping wells and flowing wells under 500 bbls. to be the actual 24-hour gauge. The pumping well as distinguished from a flowing well is defined as a well in which it is necessary to pump to produce. Thus a well pumped to stimulate natural flow is considered a flowing well.

2. Individual well potential tests are to be taken for June 1, August 1, October 1, and quarterly thereafter.

3. The potential as determined by test shall serve as the potential for the first month of each period, and the potential for the succeeding months of each period shall be determined by declining the potential for the preceding month 7 per cent per month for flowing wells and pumping wells having potentials of more than 500 bbls., and declining the preceding month's potential 3 per cent per month for pumping wells having potentials of 500 bbls. or less.

4. New wells having a potential test during the last month of a bi-monthly or quarterly period shall be given allowables for the first month of the new period based on their potential test and be declined as outlined above for the succeeding months of the new period. New wells having had potential test prior to the last month of each period shall be required to take a new potential test for the following period.

5. To arrive at a correct or disputed potential, umpire may request a 20-hour gauge on any size well.

The proration umpire and his assistants shall, from and after May 1, 1934, and until the further order of this committee, take all potential tests in the manner hereinbefore set forth.

Daily estimates for May by fields were announced as follows:

Pool—	Wells	Potential	Runs
Porter	169	132,380	20,995
Yost	12	2,655	867
Greendale	322	4,561	4,561
Vernon	44	4,095	2,362
Leaton	25	733	733
Muskegon	171	456	456
Oceana	14	269	269
Ogemaw	10	481	361
Saginaw	132	132	132
Montcalm	2	205	205
Cass	1	3	3
State's total	902	135,910	30,884

Completions

The completions in the Porter Township Pool of Midland County ranged from a hole full of oil to 2,400 bbls. estimated initial. Four were completed by Pure Oil Co. on two Neitzke leases in Section 21. These four wells accounted for more than 3,500 bbls. of the aggregate initial of 5,570 bbls. of the nine new wells. Another 2,000 bbls. of increased initial resulted through acid treatment of two Section 21 wells drilled into the Dundee.

The largest of the new Pure wells was No. 3 A. J. Neitzke, NE NW NW Section 21, drilled into the Dundee limestone to a total depth of 3,420 feet where it started flowing at the rate of 125 bbls. an hour and was estimated good for 2,400 bbls. a day. No. 2 A. J. Neitzke, SW NW SW Section 21, made 450 bbls. at 3,429 feet. Pure's Nos. 4 and 6 Walter Neitzke, Section 21, were each estimated good for slightly over 300 bbls. a day. No. 4, SW NE SE Section 21 topped the Dundee at 3,373 feet and was drilled to 3,430 feet for 305 bbls. a day, while No. 6, SE SE NE, same section, made 315 bbls. at 3,427 feet.

Stork Oil Co.'s No. 1 W. C. Breu, NE NE SE Section 20-13n-1w, the second largest, made 66 bbls. an hour from an estimated 1,500 bbls. a day in the Dundee topped at 3,387 feet and drilled to 3,423 feet. Sun Oil Co.'s No. 5 Miller estate, NW SE SW Section 16, made about 400 bbls. a day, topping the Dundee at 3,370 feet and drilled to 3,430 feet. Two 100-bbl. wells were completed by Gordon Oil Co., its No. 4 Gordon-Baxter-Teater, NW SW NW Section 22, in which the Dundee was struck at 3,353 feet and the hole bottomed at 3,462 feet, and by Empire Oil & Refining Co., its No. 1 Mabel Finch, NE SW SE Section 21, topping the Dundee at 3,375 feet and finishing at 3,427 feet. Northern Oil Co.'s No. 3 Hathaway, SW NE NW Section 18, filled up with oil but did not flow after topping the limestone at 3,387 feet and discontinuing drilling at 3,428 feet. It will be treated.

Columbia Oil & Gas Co. and Gordon Oil Co. are jointly interested in No. 1 Minnie Hale, NW SW SW Section 21, which was increased from an initial of about 150 bbls. to 1,620 bbls. a day by acid. Pure Oil Co.'s No. 2-B W. W. Hoyt, SW SE NW Section 21, estimated good for 4,500 bbls. when brought in last week, was rated at 5,113 bbls. or 613 bbls. more.

Broomfield Area

Mutual Oil and Gas Syndicate brought in its No. 1 State, SE NW Section 2-14n-6w, Broomfield Township, Isabella County, with an initial open flow of about 3,000,000 feet of gas daily in the Michigan gas sands at a total depth of 1,326 feet. The formation was topped at 1,308 feet and the first pay encountered at 1,315 feet. Gas is to be turned into the Consumers Power Co. line to Saginaw and Bay City.

A 1-mile northwest extension of the Broomfield gas pool, was proved when the Youmans-Burke Oil & Gas Co.'s No. 1 William L. Chaffee, SE NE Section 31-15n-6w, Sherman Township, Isabella County, came in for a gauged open flow capacity of 4,257,000 feet a day. The Michigan gas pay was topped at 1,384 feet and drilling discontinued at 1,394 feet, 10 feet in. A large area was believed proved by the Chaffee well with drilling of the gap scheduled to be started very soon by a number of leaseholders.

Mecosta County

The only "duster" of the past week was J. M. Taggart and others' No. 6 on the Robert S. Fish lease, C NW NW Section 9-14n-9w, Austin Township, Mecosta County. It struck bottom water at 1,463 feet.

Location was made for another test by the Taggart Brothers, Inc., C NW Section 2, Austin Township, about 1¼ miles east of its No. 4 and about a mile north of H. C. Nelson's 14,000,000-foot gasser in the Michigan series brought in about six months ago.

Columbia Oil & Gas Co. has landed drive pipe and is drilling at about 800 feet in No. 1 Albert J. Dutmer, SW SE NW Section 23-13n-8w, first of a number of tests to be drilled on a 4,000-acre community lease in Hinton Township, Mecosta County.

Montcalm County

Daily Crude Oil Co. has landed drive pipe in its No. 1 Blair, Section 11, Ferris Township, Montcalm County, and is preparing to drill a third well on the Christensen lease in Section 10, Home Township, where two upper Traverse oil wells already have been completed opening a prospective new pool. Theodore Oil Co. is waiting for drive pipe to start its No. 1 Sherwin, Section 13, Home Township, after skidding rig. First drive pipe parted and was abandoned after about 300 feet was in.

Ogemaw County

McClanahan Oil Co.'s No. 1 A. O. Guilford, SE NE NW Section 29-22n-2e, West Branch Township, Ogemaw County, reached 2,550 feet with a show of oil, gas and water on the way to the Dundee and possibly to the Monroe formation. T. F. Caldwell is preparing to carry his No. 1 E. Hart, NW SW NE Section 19, West Branch Township, from the upper Traverse to the Dundee after striking water at about 1,840 feet.

Wildcat Operations

Lawson Oil & Gas Co.'s No. 1 Atkinson, C NE SW Section 21, Lincoln Township, Midland County, struck salt water at 2,794 feet, 104 feet in the Dundee. Melvin and Brehm's No. 1 James Whitaker, Section 19, Geneva Township, is the only northern Midland County wildcat still active. It is drilling at more than 1,400 feet.

McClanahan Oil Co. is rigging up No. 1 Hicks in Section 27, Denver Township, an Isabella County wildcat, and building rig for a semiwildcat on the Oliver lease in Section 23, Porter Township.

The McClanahan company also is build-

Central Ohio Leads Central West Field; New Work Reported in All Divisions

By GEORGE A. WHITNEY
Staff Correspondent, Central West Fields

FINDLAY, Ohio, May 7.—While the Central Ohio Field shows the greatest activity of any of the divisions of the Central West Field comprising the Lima Field, Central Ohio, Indiana, Illinois and Kentucky, there is a noticeable pickup in all divisions in new work.

In the Lima Field, Kiner and others' No. 1 on the Edward Huffman farm, SW Section 34, Crane Township, Wyandot County, showed an initial of 35 bbls. at 1,385 to 1,417 feet and in the Trenton formation. The well also goes by the name of Wyanco Oil Co. It also produced 30,000 feet of gas. Jones and Doyle's test on the Harry Barron farm, Section 5, same township, is reported at 1,670 feet. Same company's No. 1 Edith Swerline farm, Section 21, Tymochtee Township, same county, is down 1,457 feet. Craig and others' test on the Oscar Berg farm, Section 28, same township, is below 1,000 feet. McPheron and others are around 1,300 feet on the Catherine Smalley farm, Section 3, Crane Township.

In Montgomery and others' No. 2 N. F. Hetrick farm, Section 3, Rice Township, Sandusky County, the prospects are rather bad, as it has drilled through the Trenton limestone, being at last report at 2,415 feet. C. H. Benke's test on his own farm, Section 36, Woodville Township, same county, in still shut down on top the Trenton at 1,220 feet. George Keyser is drilling No. 1 on the L. Gerwin farm, Section 3, same township. Michael Wagner and others' No. 1 M. Wagner farm, Section 31, Sandusky Township, same county, is a dry hole, in the Trenton lime.

CENTRAL OHIO

Central Ohio had 20 completions, three dry holes, eight gas wells and nine oil wells, with an initial of 111 bbls. The activity was centered around the shallow field, in Medina County, the oil coming from the Berea sand formation and the wells are usually fairly good producers.

In Medina County, Edson & Son's No. 29, on the E. G. Miller farm, Lot 13, Chatham Township, produced an initial of 15 bbls. from 439 to 480 feet. Same company's No. 30, same farm, had an initial of 12 bbls. from 420 to 477 feet; No. 31, same farm, produced an initial of 15 bbls. from 407 to 480 feet; No. 33 same farm, an initial of 5 bbls. from 432 to 473 feet. No. 34 was dry at 418 feet. Ohio Fuel Gas Co. has a location on the Edward C. Herr farm, Lot 1, same township, and for No. 1 Arthur S. Clark farm, Lot 45, Medina Township. Hulse and others have a location staked for No. 8 on the Des Noyes Realty Co.'s property, Lot 78, same township. F. E. Barnhart and others are drilling No. 5 W. P. White farm, Lot 17, Harrisville Township.

In Ashland County, Robinson and others' No. 8 W. S. Wolf farm, Section 16, Lake Township, produced 10 bbls. initial and No. 9 is drilling on the same farm.

In Lorain County, E. R. Edson is drilling close to 4,000 feet on the Subur-

(Continued on Next Page)

ing rig for No. 1 Converse, Section 28, Greendale Township, Midland County, northwest of the Yost area.

McHugh Oil Corp. has started operations on a large block with a test in Section 29, southwest of production in Porter Pool.

Prairie Oil Development Co. of Muir, Mich., is planning to deepen No. 1 Mary and Robert Moss, NE NE SE Section 19-8n-5w, North Plains Township, Ionia County, in which a good show of oil was encountered last week in the upper Traverse at 2,602 feet, 82 feet in. Previous light shows were reported in the lower Marshall at 1,320 feet and in the Berea at 2,000 feet. The Moss well is being closely watched as a possible indication of a southeastward trend from tests in Montcalm and Mecosta Counties.

McClanahan Oil Co. is expected to resume operations soon on No. 1 Frackleton, SE SE SE Section 18, Lincoln Township, Clare County.

With two new wildcats started in Oregon Township, Lapeer County, is a southeastern Michigan territory witnessing considerable development. Several unsuccessful tests have been drilled in Oregon Township.

Western Michigan

Formations are reported running 15 to 25 feet higher in the Muskegon Oil Corp.'s new Egelston Township wildcat than in a recent Egelston wildcat which tested good shows of oil in both the Dundee and Monroe formations. The red rock was about 25 feet higher and the Berea about 15 feet higher in this No. 1 Albert E. Gasser, SW SW NE Section 27-10n-15w. It was drilling at more than 1,250 feet.

Muskegon Development Co. moved in to carry down No. 1-D Dixie Oil Co. now owned by West Michigan Consumers Co., SW NW Section 9-10n-16w, Muskegon Township, about a quarter of a mile south of the discovery well in the old Muskegon Field.

Reed Oil Co. was ready to spud in No. 1 William Brinen, SE NW Section 13-13n-16w, Otto Township, Oceana County.

A. L. Lyon's No. 1 H. Woodworth, SE SE SE Section 5, Benton Township, Eaton County, has encountered unusually difficult drilling at about 2,600 feet.

Chapin Oil & Gas Co. is drilling at more than 750 feet in No. 1 C. R. Sutliff, Section 16, Chapin Township, Saginaw County.

Sun Oil Co. has recorded 29 leases on more than 1,200 acres in five Midland County Townships with the largest block in Hope Township and others in Lincoln, Larkin and Midland Townships.

New Locations

Four new permits, two in proved fields and two for wildcat or semiwildcat locations, were issued. An entirely new section will be tested by Charles Anderson's No. 1 Robert Cousens, SE NE SE Section 14-6s-3w, Jefferson Township, Hillsdale County, near the Michigan-Ohio State line. James P. McHugh, trustee's No. 1 Breckenridge State Bank, NW NW NW Section 29-13n-1w, will be an attempted extension test in Porter Township, Midland County.

The two locations in proved fields are Carter Lease, Inc.'s No. 3 William M. and Sophia Carter, NE SW SE Section 18-13n-1w, Porter Township, and Columbia Oil & Gas Co.'s No. 1 J. E. Simpson, NE SE SE Section 16-16n-4w, Vernon Township, Isabella County.

Central West Fields

(Continued from Preceding Page)

ban Realty Co.'s property, Lot 13, Sheffield Township. McMillan and others are below 2,300 feet on the Merle Penfound farm, Section 9, Carlisle Township. McCarnless & Beel are below 2,400 feet on the Columbus Mutual Life Insurance Co.'s farm, Lot 65, Eaton Township. In Grafton Township, Wittmer Oil & Gas Co. is below 2,600 feet in No. 1 Thomas Gammon farm, Lot 58, and its No. 1 on the Thomas B. Foley farm, Lot 58, same township, is below 1,300 feet.

In Wayne County, Faulkner & Phelps are drilling No. 5 Mary A. Smyser farm, Section 19, Chester Township. Robinson & Arn are drilling No. 1 Philip Wile farm, Section 11, Plain Township.

Knox County

In Knox County, H. E. Perkins' test on the Tom and William Moore farm, Section 13, Howard Township, is a gas well from 2,607-28 feet. He is drilling at 1,650 feet in No. 1 Carl Tucker farm, Section 13, Monroe Township. Lacknett and others are drilling around 2,200 feet on the William Adams farm, same section.

In Coshocton County, Pure Oil Co. is drilling No. 3 Roy Hayes farm, Section 5, Perry Township. Ohio Fuel Gas drilling department has a location for No. 3 R. H. Giffen farm, in the Three-quarter section, Newcastle Township. In Licking County, C. O. Moore made a location for No. 2 on the Anna Banks farm, Section 3, Mary Ann Township, and Settles Oil Co. is shut down in No. 2 Oren B. Evans farm, Section 2, same township.

In Muskegon County, Pure Oil Co. had an oil showing at 3,112 P. A. Donaldson farm, Section 7, Jackson Township, and is drilling No. 1 Oscar Mikesell farm, same section, and No. 2 on the Hoover heirs farm, Section 6. Hopewell Oil & Gas Co. is reported at 3,750 feet in No. 2 on the W. L. Hellriggle farm, Section 9, Brush Creek Township.

In Athens County, Gus Townsend's test on his own farm, Section 17, Lodi Township, is a gas well at 1,668 feet. Ohio Fuel Gas Co. is drilling No. 1 Clye Smith farm, Fractional Section 31, same township, and has a location for No. 1 on the W. H. Parmiter farm, Section 11.

In Stark County, East Ohio Gas Co.'s No. 1 W. G. Miller farm, Section 13, Jackson Township, is a gas well at 4,518 feet. Ohio Fuel Gas Co. is drilling No. 1 Rachael Beltz farm, Section 7, same township. East Ohio Gas Co.'s No. 1 John C. Mayer farm, Section 16, Plain Township, is a gas well at 4,518 feet. Same company is drilling No. 1 Mary Esselbourne farm, Section 4, same township, and has a rig in for No. 2 on the William J. Pontius farm, Section 16. Cable & Campbell are drilling No. 1 on the Avondale, Inc., property, Section 30, same township.

In Belmont County, Robert Morgan and others' test on the F. H. Magee farm is reported dry at 1,878 feet in Section 20, Richland Township. A. C. Porters and others are drilling on the Danforth-McFetridge farm, Sections 3-4, Wayne Township.

In Guernsey County, Jewell & Muhlback's test on the Jessie Milhone farm, Section 5, Monroe Township, produced an initial of 16 bbls. at 3,613 feet. Muhlback & Son's No. 1 on the Mary C. Jenkins and others' farm, Section 11, Jefferson Township, was dry at 1,215 feet. Ohio Fuel Gas Co. is drilling No. 3-5,799 on the John Johnson farm, Section 21, Willis Township, and made a location for No. 4 on the same farm. George Jewell and others are drilling on the James Henderson farm, Section 30, Oxford Township. R. W. Dunn is drilling No. 1 on the W. A. Pritchard farm, Section 9, Londonberry Township.

In Vinton County, Kachelmacher estate is drilling No. 4 Lafayette Eggleston farm, in Brown Township. Cashdollar & Co. is drilling No. 2 on the Daniel Will farm, Section 2, Elk Township. In Knox Township, Co-operative Oil Co. is drilling No. 5 on the Garfield Brooks farm, Section 3, and William Beckley is drilling No. 10 William Beckley farm, same section.

In Lawrence County, Mason Township, Chartiers Oil & Gas Co. made a location on the Dennis Burnett farm, Section 19. Ohio Fuel Gas Co. made a location for No. 1 J. B. Benson farm, Section 20, Union Township.

In Geauga County, Brooks Johnson and others are drilling on the B. W. Eddy farm, Section 7, Chester Township.

In Meigs County, Chase and others' test on the Florence M. Mutchler farm, Section 8, Rutland Township, is a gas well at 835 feet. Joe Rubin's test on the

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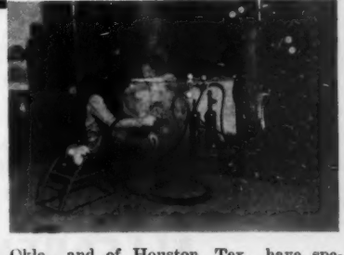

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Mattie C. Henderson farm, Section 13, is a light gas well.

KENTUCKY

Nine completions were reported in the Kentucky fields, with six completions in Ohio County, being H. L. Ogle and others' No. 1 on the A. Cooper farm, in the Deanfield area with an initial of 25 bbls. from the Jet sand. F. M. and J. M. Meredith's No. 6 produced an initial of 25 bbls. from the Jet sand. Snowden & McSweeney's No. 1 on the H. L. Odell farm, 2 miles northeast of Fordsville, same county, was dry at 700 feet. J. H. Hayne's No. 3 Ellis Himes farm, same county, was dry at 525 feet. In the Maddox Pool, Vickers and others' No. 1 on the Dock Royal farm, was dry at 500 feet, and Chenault and others' No. 3 on the P. R. R. Kelley farm was dry at 800 feet.

In Daviess County, Hupp & Duff's No. 4 Ollie Atherton farm, in the Cane Run Pool, reported an initial of 20 bbls. Daley and Daley's test on the E. Mitchell farm, in the Jones Pool, same county, is reported dry. Ellis & Ashly are drilling around 1,036 feet in No. 7 on the Dora Cooper farm, in the same pool.

In McLean County, W. W. Dameron and others' No. 9 on the L. E. Morris farm, in the Calhoun Pool, is reported with an initial production of 135 bbls. Same parties are drilling Nos. 10, 11 and 12 on the same farm. Cameron & Thompson is drilling No. 3 on the Will Ashton farm, same field, and E. N. Newton and others are drilling No. 1 Tom Crow farm, same field.

No completions were reported from Indiana and Illinois fields.

Eastern Fields

(Continued from Page 186)

has a location on the L. P. Starr farm. In Curtis district, H. F. Parsons and others have a location on the M. B. Lattimer farm.

SOUTHWEST PENNSYLVANIA

There were no completions in Southwest Pennsylvania. In Dunkard Township, Greene County, there was one dry hole. Conklin, Phillips and others drilled a test on James McClure farm through the Injun sand to 2,050 feet with plenty of water but no oil. The well may be deepened.

In Amwell Township, Washington County, Carnegie Natural Gas Co. is hauling in a rig on the N. B. Redd farm about 850 feet south of its fair well on the Fred Baumberger farm. In this township, Union Gasoline & Oil Co. is hauling in a rig for a second test on the Mary B. Lindley farm, No. 1 on this farm being a heavy producer. Philadelphia Oil Co. is down 1,165 feet on the Hulda Jenkins farm, the Pittsburgh Coal being at 735 feet. This company is building a rig for No. 2 on the same farm.

In East Findley Township, Washington County, Union Gasoline & Oil Co. is hauling in a rig for No. 2 on the J. N. Clutter farm. Levier and others are drilling at 1,885 feet on the James Marshall farm. Myers, Hoskinson and others are drilling at 550 feet in a second well on their lease of the J. N. Clutter farm. Natural Gas Co. of West Virginia is down 525 feet on the Leroy Ealy farm.

In South Franklin Township, Washington County, E. H. and J. B. Tague have started drilling No. 10 on the Adaline D. McKennan lease. Carnegie Natural Gas Co. has reached 2,040 feet in drilling deeper its well on the Iams tract. There was a show of gas in the Big Injun at 1,955 feet.

In Greene County, Wasmuth and Callahan have started hauling material on the F. W. Baldwin farm, 1¼ miles north of Ryerson Station in Richhill Township.

Oklahoma Fields

(Continued from Page 178)

75,000-foot gasser at 200-05 feet. It had been drilled to 805 feet and found no Allen sand, and was plugged back.

Anderson & Kerr's No. 1 Darrough, SW cor. Section 11-2-7, was abandoned after penetrating dry sand at 2,505-38 feet and drilling to 2,625 feet. Dry sands were found also at 1,675-1,700 feet, and 1,955-2,017 feet. This is in the northeastern end of the Fitts area.

Pittsburg County

Utilities Production Co.'s No. 2 Riddle, NE cor. Section 16-7-18, Pittsburg County, was completed. It is an 8,000,000-foot gasser at 1,811-2,020 feet.

Latimer County

Choctaw Oil & Gas Co. completed a small gas well in No. 1 Fleming, NE SE SE Section 9-6-22e, Latimer County. It started at 500,000 feet per day from Hartshorne sand at 1,465-1,727 feet.

LeFlore County

East Oklahoma Oil & Gas Co. was drilling at 1,125 feet in a 3,000-foot test, No. 1 Metcalf, SW cor. Section 2-4-26, LeFlore County

Comanche County

Miller & Goodnight Drilling Co. have machine in to start No. 1 Wilderman, NW SE SE NW Section 34-2n-12w, Comanche County.

Southern Oklahoma

In Marshall County, R. A. Godfrey's No. 1 Burge, CEL NW SE SE Section 23-7s-5e, was completed. It is a 35-bbl. pumper at 523-31 feet.

R. H. Burns was drilling at 75 feet in No. 1 Snell, NW NW SW SW Section 31-7s-6e. Letz and others' No. 1 Coatsworth, NE NW NW NW Section 32-5s-6e, was dry and abandoned at 751 feet, finishing up in black shale. Same operators' No. 2 Coatsworth, 285 feet south and 605 feet east of NW cor. Section 32, was drilling at 310 feet.

In Stephens County, Raisen Brothers' No. 5 Brown, NW NE NW SE Section 2-2s-5w, was rigging up to deepen from 460 feet. Same operators' No. 7 Brown, SW NE NE SE Section 2-2s-5w, was a 6-bbl. completion at 620-49 feet and No. 8 Brown, 510 feet from north line and 810 feet from east line SE Section 2-2s-5w, a 15-bbl. completion at 647-82 feet.

Mitchell and Cavite were drilling at 265 feet in No. 1-A Speagle, SE SE SW SW Section 10-2s-5w. J. G. Beard was drilling at 1,800 feet in No. 1 Willie, NE NE SE SW Section 23-2s-6w, an old well deepening from 1,723 feet. No. 2 on the same lease, 660 feet from south line and 200 feet from east line SW Section 23-2s-6w, is a 12-bbl. pumper from sands at 1,720-30 feet. It had been deepened.

Mudge Oil Co.'s No. 29 Wood, NW NW NE NW Section 26-1s-5w, Stephens County, is a 10-bbl. pumper at 683-700 feet. No. 30 on the same lease, NE NE NW NW Section 26, is an 8-bbl. pumper at 665-85 feet and machine was in for No. 31, twin to No. 30.

Schermerhorn Oil Co. was rigged up to deepen from 3,092 feet in No. 5 Shields, SW NE SW Section 13-1s-4w, Stephens County.

In Carter County, Carter Oil Co. made a location for No. 3 William Perkins, C SE NE SE Section 4-1s-3w, and a location for No. 3 Mary Riddle, C SW SE NW Section 4-1s-3w.

Wirt Franklin Petroleum Corp. deepened No. 2 Sprague, NW cor. Section 24-1s-3w, from 2,285 to 2,304 feet and it pumped 40 bbls. a day. It was completed.

Gulf Coast Fields

(Continued from Page 183)

feet. Smith & McDaniels' No. 1 Jones was completed for 342 bbls. daily through one-quarter inch choke at 4,285 feet.

Fort Bend County

In western Fort Bend County and centering around the E. Powell Survey, a block is reported being worked up by De Golyer and associates. Gulf and Sun are reported to have taken protection in the area.

Hankamer Field

Miramar Oil Co.'s No. 1 George Stengler, about 1½ miles south of the Hankamer Field, was drilling below 4,500 feet. Southeast of Anahuac and centering around the A. Taylor Survey, Humble Oil & Refining Co. is reported to have taken a block of around 1,000 acres.

SOUTH LOUISIANA

Tide Water Oil Co. is building derrick for a deep test on the southern part of the structure on the old Welsh Dome in Jefferson Davis Parish. The well will be carried as No. 1 Mrs. A. Bourgeois, 250 feet east and 205 feet south of center of Section 28-9s-5w, and will be carried to the Marginulina or 7,000 feet. This field was discovered in 1927 and is producing from sands around 1,300 feet, and up to January, 1934, had produced a total of 429,388 bbls. of oil. Several 4,500-foot tests have been drilled on the dome and one was carried to 6,075 feet before being abandoned.

A few miles northwest of the Welsh Field and between Woodlaw and the Iowa Field, Strake Oil Co. is reported to have taken a block of about 9,000 acres, where it has recently had a seismograph crew working the area.

West of the Lockport Field in Calcasieu Parish, Strake Oil Co. is clearing location for No. 1 Miller, 500 feet due north of Yount Lee's No. 1 Miller in Section 8-10s-9w.

Northwest of production at Sulphur in Calcasieu Parish, Union Sulphur Co.'s No. 1 Bernard Ulrich has encountered salt at 5,712 feet. At last report it was shut down for orders.

In the northeast extension area of the East Hackberry Field in Cameron Parish, Gulf Production Co.'s No. 13-A Irwin has been completed for 1,500 bbls. daily through one-half inch choke. Total depth is 7,320 feet. Red Kelly Oil Co.'s No. 1 Duhon in Section 27-12s-10w, was completed flowing 125 bbls. net oil daily with 60 per cent salt water at 3,361 feet.

At Roanoke in Jefferson Davis Parish, Shell Petroleum Corp.'s No. 1 Kratzet built up 450 pounds pressure on a seven-minute drill stem test at 8,508 feet. It showed no oil, however, it is reported to have recovered one-half joint of concentrated gasoline from the strong gas pressure.

Black and others and Edwards Drilling Co. are rigging up on No. 1 Chetimanche, about 4 miles from Franklin and in Section 34-13s-9e, St. Marys Parish.

MICHIGAN PLANT READY

The new 2,000-bbl. plant of the Midwest Refining Co. at Alma, Mich., is expected to be ready for complete operations about May 15.

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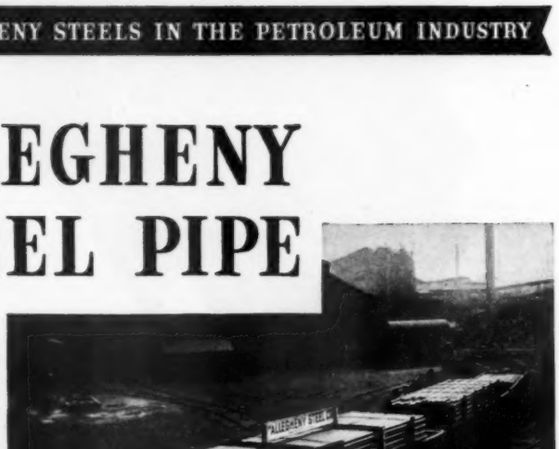

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TECHNICAL QUESTIONS ANSWERED

By Charles K. Francis, Ph. D., Technical Editor

This department of The Oil and Gas Journal is devoted to the manufacturing branches of the oil industry.

Those connected with the refining of crude petroleum, the manufacture of natural gasoline and closely allied industries are invited to submit their problems to Dr. C. K. Francis, technical editor. The department was created for the purpose of aiding managers, superintendents, engineers, chemists and all those engaged in the various phases of plant operation; also those connected with marketing and utilization of petroleum products.

Questions should be submitted in as much detail as possible.

Inquiries must be signed but only the given initials will be printed. The source of the question is considered to be confidential

Questions requiring a discussion of patents, the use of intricate formulas, extended computations, or cost estimates cannot be considered.

When the matter is of general interest the reply will be published within a reasonable time.

Material to Increase Motor Fuel Knock for Test Purposes

Is there a material that could be used to increase the knock of a gasoline, which could be used for knock testing?—L. L. S.

The standard reference fuel now in use for knock rating tests is a mixture of octane and heptane, the heptane being the knocker and the octane free from knock. It appears that heptane could be blended to produce degrees of knocking according to the quantity blended with a gasoline of some predetermined knock rating.

The U. S. Bureau of Standards has found ozone to be a powerful knock producing substance and has suggested that it may be a convenient material for use in the study of motor fuel detonation and the several theories that have been advanced concerning knock.

It appears that ozone and tetraethyl lead have opposite effects of about the same order of magnitude, and it is suggested that a study of the action of ozone may throw light on the converse results of the lead compound. As little as two-thousandths of 1 per cent, it is stated, will cause an increase in detonation equal to that caused by substituting regular gasoline for premium gasoline. By using higher concentrations, up to one-hundredth of 1 per cent, regular and premium gasolines were made to knock as vigorously as kerosene. The concentrations, however, had no effect on power, economy or optimum spark advance when using a fuel which did not detonate under the selected test conditions. It is suggested that it may prove worth while to study the effect of ozone on Diesel engine performance.

Gravity Index For Indicating Origin of Lub Oils

How is the gravity index of lubricating oils determined and what is it used for?—G. P. H.

It is well known that oils vary in gravity for a given viscosity with the source of the crude oil. The paraffin base oils, such as those produced in Pennsylvania, for a given viscosity at 100° F., have a higher gravity than a similar oil produced from the mixed base oils of the Mid-Continent. The viscosity of these oils vary with gravity, so the gravity index was devised to indicate the relationship between gravity and viscosity. A scale has been proposed, for use with lubricating oils, ranging from 100 to zero. On this scale a Pennsylvania lubricating oil should be 100 and certain oils originating in California or the Gulf Coast may be about zero.

Another similar scheme has previously been proposed by Hill and Coates for indicating the gravity-viscosity relation, designated the viscosity-gravity constant. On their scale the Pennsylvania grade oils will average about 0.80 and the coastal oils may show approximately 0.90.

The only use of a scheme of this sort is for assistance in determining the probable origin of the oil.

References.—McClure and Fenske, Ind. Eng. Chem., 24, 1,371, 1932; M. R. Fenske, Proceedings Third Pennsylvania Mineral Industries Conference, Petroleum and Natural Gas Section, May, 1933; Hill and Coates, Ind. Eng. Chem., 20, 641, 1928; Houghton and Robb, Anal. Edn. Ind. Eng. Chem., April 15, 1931, page 144; The Oil and Gas Journal, April 21, 1932, page 89.

No Relation Between Open and Closed Cup Flashpoints

How much difference is there in a closed and open kerosene flash cup in the test in temperature at flash on the average?—O. C. C.

No definite relation between flashpoints of kerosene, as determined by an open cup and the closed cup apparatus and method can be obtained. The flashpoint of a petroleum liquid is the temperature to which it must be heated before a gas or vapor will be evolved, that will ignite or explode in the presence of air when a spark or small flame is introduced. This means that the conditions of apparatus and method must be standardized; because different apparatus and different methods could not be expected to give identical or even related flashpoints. When reporting flashpoints of any petroleum product it is essential that the apparatus and method be mentioned.

A flash determination of kerosene when made in an open cup is of no value, except possibly a rough indication of the flash temperature under the particular conditions. The flashpoint test was originally devised for indicating a dangerous condition, especially an explosive kerosene and it was found that an open cup permitted the dangerous vapors to escape. The closed cup confines these vapors, and more nearly represents actual conditions.

The following is from the Significance of Tests of Petroleum Products, Committee D-2 Report, American Society of Testing Materials:

"The flashpoints of different petroleum products vary over a wide range. The more volatile gasolines and naphthas flash at temperatures considerably below 0° F. Certain special naphthas have closed cup flashpoints between approximate limits of 80 and 110° F. The normal closed cup flashpoint range for kerosene is 100 to 160° F. Gas oils and fuel oils generally have flashpoints between 150 and 300° F., and the majority of lubricating oils have flashpoints between 275 and 650° F.

"It is theoretically possible to test the whole range of petroleum products with a single flash tester but in actual practice it has been found best to use three instruments. A closed tester with a water bath and without a stirrer in the cup is best for the naphtha-kerosene group of products. For testing of fuel oils, gas oils, etc., a closed tester without a water bath and with a stirrer in the cup is preferred. Lubricating oils can be tested with the necessary degree of accuracy by the use of a simple open cup tester."

The Tag closed tester has been standardized, and has been adopted as official by the U. S. Government and many states for determining the flashpoint of kerosene.

Liquefied Petroleum Gases Sold in United States

What use is made of liquefied propane and butane as extracted from natural gas? Could you give me any figures showing the extent of this business?—K. P. J.

The development of the liquefied hydrocarbon gas business has been very rapid, the U. S. Bureau of Mines reporting a total distribution in 1928 of 4,522,899 gallons, which increased to 38,931,008 gallons in 1933. The gases now distributed in the liquefied form include what is essentially propane, butane, pentane and propane-butane mixtures.

A recent report, April 18, 1934, of the Petroleum Economics Division, U. S. Bureau of Mines, No. M.M. S. 271, gives the data following:

SEGREGATION BY USES OF MARKETED PRODUCTION, LIQUEFIED PETROLEUM GASES

(Figures in gallons)

Uses—	Propane	Butane	Pentane and propane-butane mixtures	Total 1933	Per cent 1933	Total 1933	Per cent 1932
Domestic	14,334,412	705,894	1,585,282	16,625,588	42.7	16,244,103	47.6
Gas manufacturing	199,534	6,170,670	1,948,221	8,318,325	21.4	9,703,470	28.5
Industrial and miscellaneous	1,303,784	12,179,766	506,545	13,987,095	35.9	8,167,194	23.9
Total	15,834,730	19,056,230	4,040,048	38,931,008	100.0	34,114,767	100.0
Shipped in—							
Cylinders or drums	13,299,883	124,680	991,000	14,415,563	37.0	14,396,969	42 2
Tank cars, tank wagons, or by pipe line	2,534,847	18,931,550	3,049,048	24,515,445	63.0	19,717,798	57 8
Total	15,834,730	19,056,230	4,040,048	38,931,008	100.0	34,114,767	100.0

This survey covers reports submitted by 21 companies, five of which operate in the Pacific Coast area. Deliveries of the Pacific Coast companies totaled 6,714,922 gallons in 1933, compared with 6,173,456 gallons in 1932, while the quantity marketed east of California was 32,216,086 gallons in 1933 and 27,941,311 gallons in 1932. A list of producers of liquefied petroleum gas is available upon a request addressed to the Petroleum Economics Division, U. S. Bureau of Mines, Washington, D. C.

Chemicals for Refining Petroleum Products—Chlorine

This discussion of chlorine is part of a series of short articles about the chemicals used in petroleum refining. The first was printed on this page in the issue of March 15, 1934. —Editor.

The larger part of chlorine used in the United States is obtained by the electroylsis of salt brines. The simplest reaction would be the production of sodium hydroxide chlorine and hydrogen, but there are several complications that prevent this. Chlorine slowly combines with water to form hydrochloric (HCl) and hypochlorous (HOCl) acids, the final result being the formation of chlorides, chlorates and oxygen. It is necessary to keep the initial products of the electrolysis apart to stop the formation of the secondary products and consequently a loss of chlorine. The chlorine and hydroxyl ions are separated by flowing the solution through a cell and controlling backward diffusion by means of suitable diaphragms.

The diaphragm material commonly used is asbestos prepared in sheets, similar to paper, which are placed close to the cathodes. The diaphragm cell includes a closed tank, graphite anodes set in the inner compartment from which the chlorine is discharged through a pipe, the cathodes which are separated from the inner compartment by the diaphragms, and an outer space, next to the shell, from which the hydrogen is evolved and the solution of sodium hydroxide and remaining sodium chloride is drawn off. The cathode compartment is empty, the brine seeps through the diaphragm and slowly flows down the surface of the cathode.

Chlorine was formerly sold in the form of bleaching powder, the chloride and hypochlorite of calcium, but now it is distributed in the liquid or compressed gas form. However, direct use of chlorine is not advisable in the petroleum industry. The most important use made of this element is for the purification of the lighter products, especially natural gasoline, when a very mild treatment is all that is required The calcium hypochlorite or sodium hypochlorite should be used for this purpose. One objection to chlorine treating is that in the presence of water both hydrochloric and hyphochlorous acids are produced. Many gasoline plants are operated without adequate chemical control and under conditions where large volumes of water are not available for thorough washing, so it frequently happens, that chlorine treated gasoline contains acid. Such gasoline is subject to rejection when purchased under standard specifications. For an extended discussion of hypochlorite treatment of petroleum distillates, see Chemical Refining of Petroleum, by Kalichevsky-Stagner, pages 150-161.

Properties—A poisonous gas; color, greenish yellow; symbol Cl; atomic weight 35.46; specific gravity 2.491; melting point, 151° F.; boiling point, 29° F.; combines with alkalies.

Price—Shipments made in cylinders, containing from 100 to 2,000 pounds and tank cars. Selling price of the liquid, in large quantities, approximately 2 cents a pound at shipping point.

FIELD PROBLEMS FROM READERS

Edited by Thomas F. Smiley

This department is conducted in order that men connected with the drilling, producing and transporting branches of the petroleum industry may obtain aid in solving problems that confront them in their work. Readers are invited to send questions freely. These questions will be placed in the hands of persons capable of answering them authoritatively, and the answers, based on the best available information, will be published.

Each question should give as much detail as possible, especially if it involves depth of sands, types of sands and operations on adjoining or nearby properties. The source of questions will be considered confidential, and only the initials of the sender will be published. Questions involving patented processes, intricate formulas or estimates of cost cannot be answered. If an immediate answer is important, one will be given by mail when the writer requests it.

In this connection, The Oil and Gas Journal will be glad to publish articles from field men who have devised new methods or improved old ones.

Careful Survey Highly Important in Repressuring Operations

We are considering repressuring an oil property on which we have 87 wells which are producing at the present time 3 to 15 bbls. daily. There are several abandoned wells. We have just taken up the plan and know very little about what is going to be required in order to install an efficient system. We would appreciate any suggestions concerning the preliminary steps that should be taken to insure success of repressuring operations.—L. N. G.

The importance of a thorough preliminary study of a property that is to be repressured cannot be overestimated. Certainty of success cannot be promised, but the more detailed your preliminary work and your analysis of facts collected the better your chances will be. This preliminary study should not be placed in the hands of an embryo engineer, for thorough training and ability correctly to interpret data are vital. H. C. Miller, senior petroleum engineer in the U. S. Bureau of Mines, says the initial step in a repressuring program should be a survey of all producing, dry and abandoned wells and the assembling of all available information regarding each well's past and present oil, gas and water production.

The condition of the wells and the methods by which they have been produced should also be given detailed consideration, Mr. Miller says. Information concerning the thickness of the sand in each well, location of loose and tight streaks in the sand, uniformity of the sand body and the location of the encroaching edge water are invaluable in a preliminary study of a property to be repressured.

Data on the early gas-oil ratios of producing wells indicate the texture and relative saturation of the sand about the wells; high gas-oil ratios generally indicate tight sands and low saturation or sands in close proximity to gas areas, whereas low gas-oil ratios serve to indicate areas of relatively high oil saturation in comapratively loose sands. Oil sands of low saturation, however, cannot always be definitely determined by gas-oil ratios alone, because many tight sands may be highly saturated and the oil may be produced with a high gas-oil ratio because of the ability of gas to migrate more readily than oil through a tight sand.

The location of tight-sand areas should be checked by closing in the wells and noting the time in which they build up their formation pressure. The slower the wells build up pressure the tighter the surrounding sand body. The application of vacuum to producing wells in the later life of a field when gas-oil ratios are not reliable indicators of sand conditions about the wells, will often give information regarding the texture of the sand and the degree of saturation.

A well-saturated sand of loose texture will cause oil production to increase perceptibly when vacuum is applied. A tight sand, on the other hand, may give no reaction to vacuum even when continued for several days.

A study should be made of all wells producing large quantities of water to determine if the water is bottom, top or edge water. The edge water front should be definitely located, because edgewater wells will not make good injection wells as a rule.

The structural location of the property, its location with respect to surrounding properties, and the possibility that an offsetting neighbor will not cooperate will have to be taken into consideration in the planning of a repressuring project. If a neighbor is producing his property under vacuum or under little or no back pressure and indicates that he will continue to do so irrespective of producing methods on offsetting properties, that fact will have to be taken into account in a proposed repressuring scheme because the success of any pressure restoration project depends upon confining the effects of repressuring to the property of the operator who is sponsoring the work. Every effort should be made to get the offsetting neighbors to co-operate in a repressuring project.

What Can Be Done When Mud Is Lost in Formation Holes

Can you tell me what procedure is usually followed in rotary drilling when circulation is lost? I would appreciate information as to the course followed where lost circulation is the result of fissures in the formation and that followed where it is the result of cavernous conditions, for I assume the methods are different. Is there any way of preventing loss of the mud in either of these conditions?—E. T. E.

There is no known method of preventing loss of circulation when it results from a cavernous formation that will allow any drilling fluid to run off. In the case of fissures that allow ordinary drilling mud to escape into the formation, prevention sometimes is possible by thickening the mud as much as possible. If this does not prove effective, gelling compounds may be added to the mud.

If preventive measures are ineffectual, various devices are resorted to in the hope of effecting a cure. Where the trouble is caused by fissures, it is common practice to employ mud as thick as it can be pumped and load it with cuttings, coarse sand, crushed brick or stone, etc. This often closes the opening into fissures and ends the trouble. Setting compounds are used with success. These include: (1) Five parts shale, two parts cement, with enough water added to make the mixture pumpable; (2) cement and aquagel; (3) cement; (4) gypsum plaster and borax; (5) waterglass and brine, or acid. Mixtures 4 and 5 are still being experimented with.

Experiments with waterglass preparations are reported to have produced indifferent results when used to seal crevices. Although waterglass has a pronounced stiffening effect when mixed with some muds, there is difficulty in retarding this effect until mud reaches the fissure zone where quick setting is desired. Experiments with gypsum plaster, using boric acid as a retarding agent, have shown promising results.

When the trouble is found to arise from a cavernous formation into which any drilling fluid runs without cessation, engineering practice is to use setting compounds. Trial of such compounds in the following order is recommended by men of wide experience in this type of problem: (1) Two parts cement and five parts shale, with just enough water to make the mixture pumpable; (2) cement and aquagel; (3) cement; (4) borax and gypsum plaster. If the cavern is unusually large, it may be found necessary to apply the setting compound in batches, allowing one batch to set before adding the next one. This process is repeated until a cone has been built up to the top of the cavern, which then can be drilled through. This last procedure is the method followed in the Barbers Hill Field in Chambers County, Texas.

Why Was It Called That?

DRY ICE

Dry ice, which is carbon dioxide in solid form, is called that because, so far as the human eye observes, it literally is just what its name implies. Instead of being transformed into a liquid under the influence of heat, like ordinary ice, it vanishes through evaporation into gas. A strange natural phenomenon is reported from a deep oil well at Krynica, Poland. Carbon dioxide gas, under great pressure, is forced high into the air, where it solidifies and falls back to the earth as snow, which in compressed form, is identical with the commecrial dry ice now widely used in packing ice cream, etc.

Danger of Contamination in Pipe Line Evidently Not Serious

I would like to have some information with respect to the handling of more than one grade of gasoline in the same pipe line. I understand that kerosene, gasoline and other petroleum products are pumped through the same line and I would like to know what is used as a slug between them to keep one material from contaminating another. I have been told that the Phillips Petroleum Co. handles motor fuels and lubricants in this way and I would like to know how they are separated.—M. L. M.

The Oil and Gas Journal of September 10, 1931, contained an extended article on the Phillips pipe line, from Borger, Tex., to St. Louis, Mo., which had just been put into service, and it is suggested that you refer to that article.

A question which had to be answered, and answered with certainty, before work started on construction of the Phillips line was that relating to the practicability of moving a variety of products, differing widely in volatility, through the same line. To obtain the answer to this question an experimental line was operated for a month under the direction of A. W. Hubbell, general superintendent of the pipe line company, and T. K. Willett, chief chemist. For purposes of the tests two 3-inch lines 12 miles long running between Wetumka and Cromwell in Oklahoma and owned by the Phillips Petroleum Co. were employed. One of these had been used as a residue gas line and the other as a loading line. The two were tied together at the Cromwell end, thus giving a line 24 miles long, with pumps at the Wetumka end.

Since the skin friction is greater in a 3-inch line than it is in an 8-inch line, it was assured that any operations conducted through the 24-mile experimental line between Wetumka and Cromwell could be conducted with even a greater degree of success through the 681-mile line between Borger and St. Louis. The primary problem involved was believed to be that of contamination of the different products. Could one pipe line carry such a volatile substance as liquid butane, the heaviest grade of refinery gasoline and the materials of varying distillation range that lie between these extremes without danger of serious contamination? Mr. Hubbell and Mr. Willett say this question was answered fully and absolutely by tests conducted through the experimental line. Trial slugs sent through the 24-mile line revealed that mixtures of one product with another was so slight as to be of no import in practical commercial operations.

In their consideration of what was likely to take place in a pipe line containing substances of pronounced differences in volatility Mr. Hubbell and his associates arrived at the opinion that the dangers of contamination probably had been magnified. Their tests with the Wetumka-Cromwell line confirmed this opinion.

The Phillips company produces both refinery gasoline and natural gasoline in the Borger district. In making motor fuel about two parts of the former to one part of the natural are used in the summer. In winter about equal parts of the two materials are used.

To suit the needs of the shipper the company can slug through its pipe line either the refinery gasoline, the natural gasoline or the finished motor fuel made from them.

NATURAL GAS DEVELOPMENTS

Kansas Gas Case Argued Before the Supreme Court

TOPEKA, Kans., May 7.—The Supreme Court heard attorneys' arguments in litigation between the State Corporation Commission and 10 Cities Service gas distributing concerns over the so-called 30-cent gate rate order of the regulatory body.

The commission seeks to compel the companies to show cause why they should not comply with the order that they cease to consider, in figuring domestic gas rates, any charge paid for main line gas in excess of 30 cents per 1,000 feet. The commission sought a writ of mandamus after the companies had filed injunction proceedings in the Shawnee County District Court to enjoin the commission from proceeding with the hearing.

Gas rates have been in controversy between the companies and the commission for several years. After a hearing, the commission in 1932 found 30 cents rather than 40 cents per 1,000 feet, the present charge, a reasonable rate for the Cities Service Gas Co. to charge the distributing concerns for main line gas.

After the U. S. Supreme Court had refused to enjoin the commission from proceeding under the order, the companies went into the district court to enjoin the hearing which was then ordered by the commission, contending the proper proceeding was for the regulatory body to conduct separate hearings for each point served by a company and decide upon a reasonable rate. Attorneys argued the commission could not use the 30-cent rate as a starting point.

Attorneys for the commission argued it was proper to order all the concerns in for a hearing to bring the 30-cent order to date, possibly modifying it, and then proceed with each individual point on that basis. They contended that the Supreme Court had held the 30-cent order was merely a step in proceedings to determine a rate, that a gas company, after the hearing to establish consumer rates, could appeal if dissatisfied, but that in the district court proceedings the concerns were attempting to do by injunction what they should do by appeal.

Counsel for the companies contended the commission had no right to proceed on the basis the 30-cent rate could be a starting point in determining local consumer gas rates; that the injunction proceedings were proper and that the commission's writ was not a proper remedy and should be denied.

NORPHLET RATES

EL DORADO, Ark., May 7.—A petition for a temporary injunction against officials of the town of Norphlet to prevent them from putting into effect reduced gas rates, filed by the Public Utilities Corporation of Arkansas, was granted by Judge Heartsill Ragon in Federal Court here.

The lower gas rates had been voted in an initiative ordinance by citizens of Norphlet at the municipal general election April 3. The utility was required to post $2,500 bond to protect consumers should the new ordinance be upheld in final hearing for a permanent injunction.

WICHISON RATE APPROVED

TOPEKA, Kans., May 7.—The State Corporation Commission has approved a new schedule of gas rates proposed by the Wichison Gas Co. for its domestic gas customers in Wichita. The rates are effective immediately, Homer Hoch, chairman, said.

The new schedule provides a 75-cent monthly customer charge plus 50 cents for the first 1,000 feet of monthly consumption, 40 cents a thousand for the next 19,000 feet, 35 cents a thousand for the next 80,000 feet, and 22 cents a thousand for all in excess of 100,000 feet.

This schedule, Hoch said, was slightly higher than that recently approved for the Wichita Gas Co. for the first 3,000 feet of monthly consumption, and slightly lower for 5,000 feet or more.

Community Management to Stone and Webster

ST. LOUIS, Mo., May 7.—The Community Power & Light Co., a holding company controlling utilities in Missouri, Arkansas, Kansas and Texas, has gone under the management of the Stone & Webster Service Corp., of New York.

R. G. Taber, general district manager of Community Power & Light, said the main office here and district offices in Helena, Ark.; Fort Scott, Kans.; and Cape Girardeau, Mo., will be retained.

Mr. Taber said the contract with Stone & Webster to manage the properties was effective April 16 for one year. The change from the company's own management to that of Stone & Webster involved no change in the stock setup, he said.

The company operates utilities in 60 Missouri communities, 6 Arkansas cities and 40 Kansas cities.

Headquarters of the Texas Utilities Co., which will not be under St. Louis supervision, has not been decided. It is expected, Mr. Taber said, the offices will be either in Lubbock or Plainview.

OLEAN GAS FOR JAMESTOWN

JAMESTOWN, N. Y., May 5.—The city of Jamestown which has municipal electric service, is considering entering the municipal gas field. A committee has been created by the common council to study the possibility of distributing gas as a public utility. An offer has been made to bring gas here from the Olean gas fields and sell it to the municipality at the city line.

ARIZONA FRANCHISE

A certificate of convenience and necessity has been granted by the Arizona Corporation Commission to the Natural Gas Service Corp., of El Paso, Tex., which proposes to serve certain rural districts in four southern Arizona counties now traversed by the recently completed Douglas-Phoenix natural gas extension of the Western Gas Co. from the Lea County fields in New Mexico. Rates will be the same as those in the nearest city areas where natural gas is distributed through local utilities.

OKLAHOMA CASE ARGUED

WASHINGTON, D. C., May 7.—An order of the Oklahoma Corporation Commission fixing the price of natural gas furnished the Oklahoma Packing Co. at Oklahoma City, Wilson & Co., was argued in the Supreme Court. Robert M. Rainey, counsel for the Oklahoma Gas & Electric Co. and the Oklahoma Natural Gas Co., assailed the validity of the order.

COLUMBIA GAS INCOME

Columbia Gas & Electric Corp. reported March quarter net income of $5,504,607, compared with $5,466,673 in the corresponding period of 1933. For the year ended March 31 net income of $12,534,692 was equal to 50 cents a common share, compared with $16,190,278, or 86 cents a share, in the previous 12 months.

Supreme Court Sustains Ohio Commission Rates

WASHINGTON, D. C., May 7.—Rates on natural gas fixed by the Dayton Power & Light Co. at various places in Ohio have been set aside by the Supreme Court. The decision sustained rates fixed by the Ohio Public Utilities Commission.

The company increased its rates to consumers in Troy, Piqua, Sidney, Tippecanoe City, North Hampton, South Charleston, Washington Court House and in territory adjacent to Wilberforce and Troy. The Ohio Public Utilities Commission declared the rate too high and the Ohio Supreme Court set it aside, ordering a refund of approximately $300,000 which had been collected since June, 1929, in excess of the old rate.

Justice Cardozo, in delivering the opinion, stated that, while the court could not completely approve the action of the Ohio Public Utilities Commission or the Ohio Supreme Court, the rates prescribed by the commission, which were the old rates and which the company proposed to raise, were not confiscatory and would not be revised by the high court.

The court's opinion devoted much space to a consideration of the valuation for rate-making of leases held by the Ohio Fuel Gas Co., from which the Dayton concern buys gas. Both concerns are subsidiaries of the Columbia Gas & Electric Corp.

The court pointed out that the leaseholds fall into four groups: Acreage from which gas is now being furnished to the public, good gas producing lands on which producing wells are not now located, acreage reasonably certain to be good gas land, and merely prospective gas lands.

The Ohio commission held that only leases in the first class should be valued in estimating a fair return.

"Is the appraisal of the leases at more than $7,000,000 an arbitrary act, which in turn has brought about an arbitrary rejection of the contract for gas delivered at the gates, and hence an infringement of constitutional immunities?" the Supreme Court asked.

"As to that issue," it went on, "the burden of proof rests heavily on the appellant. . . . in the endeavor to sustain it there has been an attempt to establish market and intrinsic values by the estimates of experts as well as by actual sales.

"Webber, a witness for the appellant, placed the value of leases in Class No. 1 at $11,473,717; Meals at $17,483,760; Wittmer at $21,825,000, and Dally at $26,225,640."

The court also cited the valuations by experts of the other classes of leaseholds.

"Variations so wide are sufficient of themselves to disprove the existence of a market in the strict or proper sense," the court said.

"If they have any probative effect," the court went on, "it is that of expressions of opinions by men familiar with the gas business and its opportunities for profit. But plainly opinions thus offered, even if entitled to some weight, have no such conclusive force that there is error of law in refusing to follow them."

KANSAS CITY PETITION

KANSAS CITY, Mo., May 7.—Hearing on a suit for a writ of mandamus to require the city clerk to certify to city council initiative petitions for the election for a municipally owned gas plant, was held in Circuit Court before Judge Seehorn. The court ordered the petitioning group to post bond for the cost of subpoenaing witnesses. The suit was filed by George C. Johnson, a home owner and taxpayer, following the clerk's refusal to certify a petition containing 7,000 names, submitted to the council by a committee headed by Edward White.

Gas Revenues Increase; 181,500 More Customers

Manufactured and natural gas industry had total revenues of $69,056,900 in February, as compared with $67,064,600 in February, 1933, an increase of 3 per cent, according to the American Gas Association. Revenues of the manufactured gas industry were $34,241,800 for the month, a gain of nearly 4 per cent over February, 1933, while the natural gas industry's revenues increased 2.1 per cent to $34,815,100.

Sales of manufactured gas aggregated 33,425,400 feet, an increase of 11.9 per cent and natural gas sales were 94,349,200 feet, a gain of 11.4 per cent.

Customers for the entire industry increased 181,500 to 15,376,100, as of the end of February.

Sales of manufactured gas for domestic purposes increased 2 per cent over the corresponding 1933 month, and commercial sales gained more than 22 per cent; in the natural gas field commercial sales gained over 27 per cent compared with the year before.

Sales of manufactured gas for house-heating purposes showed a gain of over 57 per cent in February compared with the corresponding month of 1933.

PITTSBURGH COMPANY RATES

TOPEKA, Kans., May 5.—Homer Hoch, chairman of the State Corporation Commission, announced the commission has approved a new schedule of rates proposed by the Pittsburg Gas Co. for its domestic gas users.

The new rates are $1.50 for first 1,000 feet of monthly consumption, $1 per 1,000 for the next 2,000 feet, and 50 cents per 1,000 for all over 2,000 feet with a minimum monthly bill of $1. Based on last year's bills, Nels Anderson, rate engineer for the commission, said the total annual savings to consumers would be about $10,500.

GAS AT THE FAIR

The gas industry will be present, with a new exhibit, when the 1934 Century of Progress Exposition opens in Chicago on May 26. This year the gas exhibit will especially emphasize the utilization of gas in modern appliances. The latest models will be portrayed in model kitchens, basements and other suitable settings to complete a well-rounded story of direct appeal to the user and prospective user of gas.

CALIFORNIA CASE DROPPED

LOS ANGELES, Calif., May 5.—The hearing of Pacific Gas & Electric Co. against the California Rialroad Commission in which an injunction against the commission's order for a natural gas rate reduction is sought has been dropped from the Federal Court calendar subject to the right of either party to reset the case. Request for postponement was made by counsel for the commission with counsel for the company consenting.

EIGHTEENTH HEBRON GASSER

BRADFORD, Pa., May 5.—The Oswayo Chemical Co. drilled in a 16,000,000-foot gas well in the western end of the Hebron gas field in Potter County this week. It is the eighteenth Oriskany sand gas well in the field, and extends the field.

MARKET RECORD OF OIL SECURITIES

Active Oil Stocks Listed on New York Stock Exchange

Compiled by Carl H. Pforzheimer Co., 25 Broad Street, New York City, Members New York Stock Exchange and New York Curb Exchange

1934 High	1934 Low	Week ended May 5 Sales	High	Low	Close	Stocks—	Total shares outstanding	Par value	Dividend rate	Payable or last paid	1933 High	1933 Low	1932 High	1932 Low	1931 High	1931 Low
53¾	41½	5,600	51	48½	50½	Amerada Corp.	774,875	N.P.	50cQ	1-31-34	47⅝	18½	22¾	12	23	11¼
35¼	26¼	14,300	28	26¼	26¼	Atlantic Refining	2,673,834	$25	25cQ	3-15-34	32½	12⅝	21⅞	8⅝	23⅝	8⅝
10	7¾	17,100	8⅝	8	8	Barnsdall Corp.	2,186,385	$5	....	5-11-31	11	3	7	3⅝	14½	4
19¼	11⅛	45,300	15	11⅞	12⅞	Columbia Gas & Elec.	11,610,036	N.P.	12½cQ†	2-15-34	28⅛	9	21	4¼	45⅝	11⅝
14¼	9¾	34,700	12⅜	11⅜	11½	Consolidated Oil Corp.	14,218,835	N.P.	28c	4- 7-34	15¾	5	9	4	15⅞	4⅞
22¾	16½	40,000	21	19⅛	19¾	Continental Oil of Delaware	4,738,593	$5	25c	4-30-34	19⅝	4⅞	9⅜	3⅝	12	5
22¼	15⅛	11,200	21⅝	20	20	General Asphalt	387,149	$10	....	6-15-32	27	4⅝	15½	4¾	47	9⅜
5⅜	4¼	2,100	4⅝	4¼	4⅜	Houston Oil (new)	1,098,618	$25	....	10-17-30	7⅜	1⅞	5⅜	1⅛	14⅛	3
3⅜	1⅜	1,500	2¼	2	2	Louisiana Oil Refining	1,302,158	N.P.	....	.....	4	⅝	2¼	½	4½	1
14⅜	11⅝	5,000	13¾	12½	12¾	Mid-Continent Petroleum	1,857,912	N.P.	25c	5-15-34	16	3¾	8⅞	3¾	16¾	5
20¾	11½	3,100	18⅛	16⅝	16⅝	National Supply of Delaware	382,591	$25	....	5-15-31	28⅝	4	13	3½	70¼	5
15⅞	12	28,500	13	12	12	Ohio Oil Co.	6,563,107	N.P.	....	12-15-32	17⅝	4¾	11	5	19½	5⅛
8⅝	6½	1,900	7⅞	7½	7½	Pacific Western Oil	1,000,000	N.P.	25c‡	10-25-33	9½	3	8	3	15	2⅝
2½	1¼	900	1⅞	1⅝	1⅝	Panhandle P. & R.	198,770	N.P.	....	.....	4¼	⅜	1¼	¼	4¼	⅜
20¾	15⅛	42,400	19⅛	17½	18½	Phillips Petroleum	4,155,113	N.P.	25c	5-14-34	18¾	4¾	8½	2	16⅝	4
16¾	12½	6,400	13¼	12½	12½	Plymouth Oil Co.	990,261	$5	25cQ	3-31-34	17⅝	6¾	12½	6	19	6
14⅞	10⅛	18,700	12	11	11	Pure Oil	3,038,370	N.P.	....	9- 1-30	15⅝	2½	6½	2⅜	11⅞	3¼
39⅛	33	1,100	35½	33	35½	Royal Dutch N. Y. shares	432,224	$14	$1.07½	8-14-33	39¾	17⅝	23¾	12⅛	42⅝	13
38⅜	25⅜	5,700	36	34¼	34⅝	Seaboard Oil of Delaware	1,204,460	N.P.	15cQ§	3-15-34	43⅜	15	20⅜	6⅝	20¾	5½
11⅞	7⅝	13,900	9⅛	8⅝	8⅞	Shell Union Oil	13,070,625	N.P.	....	6-30-30	11⅝	4	8¾	2½	10¼	2½
89	58	200	76	75	76	Shell Union Oil pfd.	400,000	$100	....	7- 1-31	61	28½	65¼	18	78	15
11¼	9	1,800	10¾	9½	10	Simms Petroleum	461,000	$10	25c	1-17-34	12⅜	4⅞	7½	3¼	11	3½
11½	7⅞	4,200	10⅜	9⅞	10¼	Skelly Oil	1,008,514	$25	....	12-15-30	9⅞	3	5¾	2½	12⅞	2
19⅞	15⅛	49,300	16½	15⅜	15⅞	Socony-Vacuum	31,019,694	$25	15cQ	6-15-34	17	6	12¼	5¼	21	8⅜
42⅞	33⅛	24,800	36½	33⅛	33½	Standard Oil of California	13,102,980	N.P.	25c	6-15-34	45	19½	31⅞	15⅛	51¾	23½
41	33⅞	200	40	40	40	Standard Oil of Kansas	200,000	$10	50cQ	4-30-34	39⅞	12⅜	16½	7	19	7⅜
50⅛	43⅛	51,900	45¼	43⅛	44	Standard Oil of New Jersey	25,740,965	$25	50cSA	6-15-34	47½	22¾	37⅜	19⅞	52½	26
62	51½	1,000	61	59¾	61	Sun Oil	1,591,110	N.P.	25cQ	6-15-34	59	35	39⅞	24⅜	45¼	26¾
29⅜	23½	13,700	26⅜	25	25	Texas Corp.	9,486,417	$25	25cQ	4- 1-34	30½	10⅜	18¼	9¼	36¼	9⅞
6½	3⅛	4,600	4⅝	4¼	4⅜	Texas Pacific Coal & Oil	880,703	$10	....	12-31-29	6½	1⅜	4	1½	6½	1⅜
14¼	8½	43,000	13¼	12½	12¾	Tide Water Associated	5,613,800	N.P.	....	2-16-31	11¾	3⅛	5⅝	2	9	2⅛
84¾	64½	1,800	85⅛	83¾	84	Tide Water Associated pfd.	666,524	$100	$1.50Q	12-23-33	65¼	23½	60	20	68	20½
20½	15⅞	6,500	17⅜	16¼	16¼	Union Oil of California	4,386,070	$25	25cQ	5-10-34	23⅜	8½	15⅜	8	26⅝	11
21	15⅝	1,200	20½	19½	20⅛	Union Tank Car	1,200,000	N.P.	30cQ	3- 1-34	22¾	10½	19¼	11¾	25⅛	16
5¾	3⅝	1,500	4⅝	4	4	Wilcox Oil & Gas	424,839	$5	....	5-10-28	5½	2	8¾	2¾	9⅜	2¾

*Ex-dividend. †Payable in 5 per cent convertible preferred stock. ‡Initial dividend. §Plus extras.

Active Oil Stocks Listed on New York Curb

Compiled by Carl H. Pforzheimer Co., 25 Broad Street, New York City, Members New York Stock Exchange and New York Curb Exchange

1934 High	1934 Low	Week ended May 5 Sales	High	Low	Close	Stocks—	Total shares outstanding	Par value	Dividend rate	Payable or last paid	1933 High	1933 Low	1932 High	1932 Low	1931 High	1931 Low
38	31¾	200	36½	34½	34½	Buckeye Pipe Line Co.	200,000	$50	75cQ	3-15-34	39¾	25	35	17½	56	30
5½	2¾	1,900	4	3½	3⅝	Carib Syndicate	579,000	25c	....	.....	7¾	¼	¾	¼	2⅝	¼
126½	118½	50	126½	126½	126½	Chesebrough Mfg. Co.	120,000	$25	$1Q†	3-30-34	129	71	90	53	129½	75
4¼	1¾	32,900	3	2¾	2⅞	Cities Service	37,804,394	N.P.	....	6- 1-32	6¼	1½	6⅞	1¼	20¾	5
3¼	1¼	1,300	2½	2⅜	2⅜	Colon Oil	2,200,000	N.P.	....	.....	4	¼	1¼	¼	3⅛	¼
3⅞	1⅝	300	2½	2⅜	2⅜	Cosden Oil	399,687	$1	....	.....	3⅞	1⅜	2⅞	¼	3¾	⅜
13⅜	9⅝	10,500	12⅞	12	12¼	Creole Petroleum	6,974,356	$5	....	.....	12	4¾	3⅛	1¾	3⅞	1⅜
7½	4¾	700	6⅞	6⅛	6⅛	Darby Petroleum	509,696	$5	25c	2-15-34	8	2⅛	7⅛	1⅝	2½	1⅜
2¼	1⅝	500	2	1¾	1¾	Derby Oil & Refining	263,162	N.P.	....	.....	2¾	⅞	3	1	6	1½
36	31	50	35½	35½	35½	Eureka Pipe Line	50,000	$100	$1Q	2- 1-34	41¾	20	35	18	36	19
76¾	58½	2,300	64¼	63	63	Gulf Oil Corp.	4,538,101	$25	....	10- 1-31	62	24	44¾	23	75½	25⅜
46⅜	33½	5,200	44⅞	41½	43¼	Humble Oil & Refining (new)	8,923,935	N.P.	25cQ	4- 1-34	105½	40	55	35⅝	72	44½
15⅛	12⅝	17,700	15⅛	14½	14⅝	Imperial Oil of Canada	26,857,152	N.P.	25cSA†‡	6- 1-34	15⅞	6½	10⅞	6¼	18¼	7⅜
6⅞	3⅞	300	5⅝	5½	5½	Indiana Pipe Line	300,000	$10	15cSA	5-15-34	8	3⅛	7½	2¾	21⅛	5½
27⅜	19⅜	21,500	27¼	26	26⅝	International Petroleum	14,247,088	N.P.	56cSA†‡	6- 1-34	23½	8⅞	12¼	8	15½	7⅜
3¾	2⅛	3,900	3	2⅞	2⅞	Louisiana Land & Exp.	3,000,000	N.P.	....	.....	2¼	⅛	2½	½	2	½
5⅞	4	100	4⅞	4⅞	4⅞	Lion Oil Refining	270,000	N.P.	....	10-27-30	9½	1¼	3½	⅞	6¾	1½
8¾	4¾	5,400	7⅜	6⅞	6⅞	Lone Star Gas	5,382,723	N.P.	16cQ§	3-31-34	11⅞	4¾	11	3⅝	29	5½
5½	4	3,000	5⅛	4¾	4⅞	Mountain Producers	1,682,182	$10	15cQ	4- 2-34	6½	2½	4¾	2⅛	5⅞	2
18⅛	14	2,500	17	16	16	National Fuel Gas	3,810,183	N.P.	25cQ	4-16-34	20	10	14⅝	8	28½	9¾
9½	8	No sales ..	..	..	..	National Transit	509,000	$12.50	40cSA	6-15-34	10	5½	10½	6	17½	5
2⅛	1¾	500	2	1⅞	1⅞	New Bradford Oil	1,445,202	$5	10c	3-15-34	2⅛	½	⅞	⅛	1½	½
2¾	1	800	1½	1½	1½	New Mexico and Arizona	1,000,000	$1	....	.....	1⅞	½	1¼	⅜	3	⅜
4¾	3	100	4	4	4	New York Transit	100,000	$5	15cSA	4-14-34	4⅞	3	9¾	7½	14½	5⅞
7·	4⅝	200	5⅞	5⅞	5⅞	Northern Pipe Line	120,000	$10	25cSA	1- 2-34	6⅛	4¼	5½	3⅛	35½	20
2⅝	⅞	4,100	2⅛	1¾	1¾	Pantepec Oil	1,608,700	N.P.	....	.....	3¾	⅛	⅝	1/16	2	⅜
3⅛	1¼	100	2	2	2	Ryan Consolidated	296,931	N.P.	....	.....	4⅛	⅝	2⅛	⅝	3	⅜
7⅞	5⅜	1,900	7	6½	7	Salt Creek Producers	1,496,859	$10	20cQ	5- 1-34	9¼	3½	5½	2⅞	7⅝	2⅜
24¾	17½	2,800	24	22⅜	23½	South Penn Oil	1,200,000	$25	30cQ	3-31-34	22¼	11	16½	9⅝	23⅞	9¼
4¾	4	100	4½	4½	4½	Southern Pipe Line	100,000	$10	10cSA	3- 1-34	6	2⅛	10	3¾	17	7
47	41	No sales ..	..	..	..	Southwest Penna. Pipe Lines	35,000	$50	$1Q	4- 2-34	43	24½	37	27	42½	25
32¾	25	38,300	27	26⅛	26⅝	Standard Oil of Indiana	15,941,894	$25	25cQ	3-15-34	34	17	25⅛	13⅛	38½	13½
17⅝	14⅝	3,500	16⅜	15¾	16	Standard Oil of Kentucky	2,606,983	$10	25cQ	3-15-34	19¼	8⅜	15⅞	8⅞	23⅝	12⅛
16⅝	13½	100	14½	14½	14½	Standard Oil of Nebraska	190,822	$25	25cQ	6-20-34	20½	11	19	10¼	36½	16
27½	20	600	20¼	20	20¼	Standard Oil of Ohio	753,740	$25	....	1- 3-33	41	15½	30⅛	15½	62½	23
2	1/16	3,000	1½	1¼	1⅜	Sunray Oil	1,162,840	$5	....	4-15-31	1½	¼	⅝	⅛	5¼	¼
11	5⅝	1,300	6⅝	6⅛	6⅛	Texon Oil & Land	936,028	N.P.	15c	3-31-34	13¾	6¼	10½	4½	12⅞	2½

*Ex-dividend. †Plus extras. ‡Payable in Canadian funds. §Payable in preferred stock.

Note—In comparing highs and lows for the several years in the two tables, it will be necessary to take into consideration cases where there have been stock split-ups.

Construction Features Use Reconditioned Pipe

(Continued from Page 41)

welder to work completely around the pipe as it cannot be turned once it has been lowered into place.

Bell Hole and Firing Line

In the days when cast iron pipe was used the joints were made with a "bell and spigot." The end of the pipe was enlarged or "belled" and the end of the next joint slips into this bell and the joint made tight by caulking with lead. To permit the workman to drive this lead into place it is necessary to dig a large hole in the ditch and this has always been referred to by the pipe line workers as the "bell hole" to differentiate between it and any other hole dug along the right of way looking for leaks or for other purposes.

The term "firing line" is of much more recent origin. It probably had its inspiration from the old battle lines during the World War. The ditch lies in front of the welding gang and the earth is thrown up so it has the general appearance of a trench. Along the side of this open ditch the pipe is mounted upon supports or horses and as several men are engaged in this work at one time the appearance is similar to the "firing line" along the trenches.

This is especially true when the acetylene torch is used because as the gas is ignited a slight popping sound is heard and the flare of the torch and the general scene might readily be likened to the "firing line" along the war trenches. The term sticks even though electric arc welding is used and does not have the same pyrotechnic effect as produced by the acetylene torch.

To weld the pipe into length for final assembly into the completed line it is necessary to find suitable space alongside of the ditch or elsewhere to string out the pipe into a straight line. In crossing over hilly country it has often been found impossible to string the pipe parallel with the ditch so the firing line worked on a location at right angle to the ditch. Or the pipe might be joined at some place below the summit of the line and dragged to the ditch for assembly.

The pipe is laid upon supports or horses and then picked up by a tractor at each end of the section and swung over the ditch and laid upon "dollies" or heavy timbers placed across the ditch to keep the pipe from entering until it has been welded together. This changes the technique of the bell welding gang somewhat for they can work on the under side of the pipe by getting into the ditch, but usually the ditch is widened somewhat at these points to give the welder plenty of elbow room.

It is necessary for the tractors handling the long sections of pipe to line up each section and to butt the ends together so the weld can be made. This operation requires that the whole section of pipe be free to move sidewise and endwise over the ditch. The operation is accomplished by experienced tractor operators without great difficulty and as the sections lie upon the dollies over the ditch the welders of the "bell hole" gang do their work.

Coating and Wrapping

Whether new or old pipe is being used the next operation following the bell hole gang welding is to clean the pipe thoroughly. The traveling type pipe cleaning machine is now used extensively for this purpose. It is mounted on the pipe and has either one or two revolving heads that are equipped with cutters and brushes. These heads are driven by a Ford truck motor mounted on a frame above the pipe and the power is transmitted through the standard Ford transmission with four forward and one reverse speed.

The engine also furnishes power to move the cleaner along the pipe and from 1 to 1½ miles of pipe can be cleaned daily with this outfit. The cutters are mounted in rings that can be expanded or contracted to fit from 2 to 14-inch pipe. With the double head W-K-M machines 320 cutter rings are used and 12 wire brushes. As these cutters and brushes rotate around the pipe all foreign material is removed and the machine travels forward at speeds varying from 6 to 30 feet per minute.

The pipe is suspended over the ditch during this operation by a boom mounted upon a tractor that travels just ahead of the cleaning machine. The pipe is swung in a cradle made of three large rollers mounted in double yokes so designed as to permit each roller supporting the pipe independently of the other two. The yokes and suspension rods are so designed the rollers are independent of each other and the principle was taken from the method of hitching three horses for plowing.

As the tractor with the suspended pipe moves alongside the ditch the pipe is held up long enough to permit the cleaning machine to perform its work and then lowered to the dollies or heavy timber supports across the ditch. Men follow the cleaning machine closely with wire brushes and rags and remove all traces of dirt or rust that may be on the pipe after the machine has passed on.

Immediately after the pipe has been cleaned it is covered with a coat of primer by a crew using a sling and applying the coating by hand method. This primer coat protects the pipe against moisture during the interval between cleaning and coating with protective material.

The next operation of coating and wrapping the pipe is done by another crew accompanied by a tractor with boom and pipe cradle similar to that used by the pipe cleaning and priming crews.

The pipe is resting upon the dollies over the ditch where the priming crew left it and the tractor picks the pipe up and holds it suspended over the ditch while the coating machine is pushed forward along the pipe and applies just the right amount of hot asphalt coating to the pipe to cover it about three-thirty-seconds of an inch thick all over. This is important because one difficulty experienced in the past in using hot coating preparations has been their tendency to run to the low side of the pipe and drip off or thicken the coating there.

With the Gardiner coating machine this difficulty has been overcome and as rapidly as the pipe is coated with a hot asphalt mixture known as "Paroline" it is wrapped with strip asbestos felt paper prepared especially for this purpose by Johns-Manville Co. and applied by its pipe wrapping machine.

Hot coating and wrapping 12-inch pipe being laid by Stanolind Pipe Line Co. in Kansas

This light machine is hand operated and holds the roll of felt paper at the proper angle to insure a spiral wrapping of the pipe. The paper is applied under sufficient tension to press it into the cooling coating and the bond between pipe, coating and wrapper is insured. Just a little of the asphalt will squeeze out ahead of the paper if the temperature of the coating is right, and as the next lap of paper covers this squeezed-out coating the bond is complete.

Following the paper wrapping gang is the crew applying another coat of hot asphalt to the outside of the felt paper to provide against any possible slight imperfections in the job. This outer coating is put on more as a precautionary measure, but illustrates the extreme attention paid to details in this new type pipe line construction.

Lowering Into Ditch

Up to this point everything has been above ground where it was possible to keep close check upon all details. The next thing is to bury the pipe and this is where the pipe passes out of sight, and in the past back filling has been considered as a necessary evil, as it were, so it has been done as quickly as possible.

But with the modern pipe line construction practice it is deemed poor policy to take every precaution to clean, coat and wrap pipe and then dump it into the ditch and throw in any kind of material found along the right of way on top of it. In fact, it has been found the bottom of the ditch should be prepared to receive the pipe, especially where the ditch runs through rocky ground.

The bottom of the ditch is filled with sufficient earth to insure a complete protection from rough rocks or stone. If the bottom of the ditch is actually in rock it is necessary to deepen the ditch enough to accommodate this cushion of soft earth that is to be spaded in before the pipe is lowered.

When the pipe has been lowered into the ditch by the use of the tractor with boom, the men throw in sufficient additional soft earth to completely cover the pipe and give it protection from the material to be later pushed into the hole by the back fillers.

All of this precaution is necessary for it has been found throwing rock upon the pipe coating or lowering the pipe into the ditch and allowing it to rest upon jagged rocks has caused the felt wrapper and coating to be punctured and the pipe to become exposed. One or two small spots of this sort may ruin a long section of pipe, so every precaution is taken to keep the rock and stone away from the pipe.

The remainder of the ditch is filled by back fillers or some other form of mechanical device that drags or pushes the material removed from the ditch back into it. This operation completed, the pipe line is ready to tie into the manifolds at the stations. It is believed with the care given to details and the welded pipe these relaid lines will serve for many years and the contention seems to be further borne out by the fact the reclaimed pipe that has served for 10 years or more in the old system is still in good condition and it did not receive any such elaborate treatment. Hot spots and leaky couplings caused most of the trouble in the old lines and it is to eliminate them the care is taken in relaying the lines.

Supreme Court of Texas to Review Rule 37 Case

AUSTIN, Tex., May 5.—The Texas Supreme Court has agreed to review a suit in which the construction by the Texas Railroad Commission of Rule 37, oil well drilling regulation, is questioned.

The case centers on a widely discussed opinion by the Third Court of Civil Appeals holding that tracts of oil land capable of development as a whole cannot be subdivided to obtain additional wells and that subdivision agreements must be made in accordance with, and not in violation of, the commission's rules relative to well spacing.

The suit is that of Maurice Stewart and was appealed from Travis County.

Mr. Stewart sought a permit to drill on a small piece of land in Gregg County that formerly was part of another tract. The Railroad Commission denied the permit with the statement that if Mr. Stewart was allowed a permit the owner of the other portion also must be granted one. The commission stated one well on the consolidated tract was ample to protect it from drainage and recommended that they be reconsolidated and a permit to drill one well granted.

Mr. Stewart cited a dissenting opinion by Justice M. B. Blair of the Third Court of Civil Appeals to support his contentions. Justice Blair asserted the majority opinion was "wholly untenable" and that the Railroad Commission did not have authority to require consolidation of separate interests in oil tracts.

PERSONAL PARAGRAPHS

P. C. JONES, general manager of the S. M. Jones Company, of Toledo, Ohio, was a Mount Pleasant, Mich., oil field visitor last week.

* * *

S. M. BLAIR, of Trinidad Leaseholds, Ltd., has returned to London, England, from a visit to the United States.

* * *

H. F. SCHOONOVER, production superintendent for the Pure Oil Company, Fort Worth, Tex., is back at his home and getting along nicely after a serious siege of pneumonia.

* * *

W. H. CRAMER, of Newark, Ohio, district manager of the Jarecki Manufacturing Company, in Muskegon and Mount Pleasant, Mich., visited H. A. CORBIN, manager of the Mount Pleasant store, last week.

* * *

EUGENE HOLEMAN, official of the Mexican and South American subsidiaries of the Standard Oil Company (New Jersey) with headquarters in New York, is now on an inspection trip of the South American properties of the companies.

* * *

J. W. CASHDOLLAR, of the Wittmer Oil Company, Pittsburgh, Pa.; NOAH ANDREWS, of Logan, Ohio; JOHN ELDER, of Junction City, Ohio, and L. B. SPANG, of Butler, Pa., were recent visitors in Central Michigan oil fields at Mount Pleasant, Mich.

* * *

LOUIS J. BRUNEL, vice president and general manager of the Bishop Oil Company of San Francisco, Calif., stopped in Michigan last week to visit the Muskegon and Mount Pleasant Fields, on his way to New York. The Bishop company is planning to operate in Michigan fields.

* * *

A. G. OLIPHANT, oil producer of Tulsa, is recovering following an emergency appendicitis operation.

* * *

DR. P. ZURCKER has returned to Ponca City, Okla., from Baltimore, Md., where he has been on business.

* * *

BUFORD PENN has been transferred from Sand Springs, Okla., to the East Chicago, Ind., laboratory of Consolidated Oil Corporation.

* * *

W. K. WHITEFORD, vice president in charge of production for the Barnsdall Oil Company, Tulsa, has just returned from a business trip to Texas.

* * *

C. F. KIMBALL, formerly of Oklahoma, has been transferred to Midland, Tex., to scout the West Texas district for the Sinclair Prairie Oil Company.

* * *

ALFRED WILSON is now connected with London, England, office of the Cities Service Export Oil Company, Ltd. He was formerly with the Russian Oil Products, Ltd.

* * *

DR. MORGAN P. MATUSSAK, formerly of the Pittsburgh station of the Bureau of Mines, and JOHN PAUL JONES, of the Oklahoma University, have recently joined the research group at Phillips Petroleum Company.

* * *

HARRY E. BORGERT, formerly sales manager of H. F. Wilcox Oil & Gas Company, Tulsa, has joined the sales force of the American Petroleum Company and will make his headquarters at the Chicago office in the Straus Building.

HARRY TOPE has returned to Mount Pleasant, Mich., after a visit to Pittsburgh, Pa.

* * *

FRANCIS E. POWELL, formerly chairman of the Anglo-American Oil Company, London, England, is visiting in New York.

* * *

CHARLES BIHOREAU has been appointed technical director of the French Office of Combustible Fuels, to succeed PAUL DUMANOIS.

* * *

VISCOUNT BEARSTED, M.C., and LADY BEARSTED have returned to London, England, at the conclusion of their cruise to the West Indies.

* * *

W. H. COOS, vice president of the Comet Oil Company, subsidiary of the Texas Pacific Coal & Oil Company, has been transferred from Great Falls, Mont., to Fort Worth, Tex., where he was formerly in the sales department.

* * *

R. CLAY UNDERWOOD has left the Texas Railroad Commission forces at Midland to become executive assistant in the North Texas Oil and Gas Association office at Wichita Falls. W. C. FRITZ succeeded him at Midland in the commission office.

* * *

JACK DEMPSEY, former heavyweight boxing champion, visited several Michigan oil fields last week, notably the new Montcalm Pool in Central Michigan. He is interested in oil operations in East Texas.

* * *

C. B. CLEMENT, formerly division engineer for the Texas Company at Wichita Falls, Tex., has been transferred to Olney, Tex., as production foreman. RAY WIGHT, formerly gas foreman at Pampa, Tex., has been moved to Wichita Falls to become division engineer in that district.

R. D. SHAW, sales manager for Dowell Incorporated, Tulsa, has returned from a trip to various areas in Texas.

* * *

H. KANE GREENLEAF, scout and land man for the Phillips Petroleum Company, has been transferred from San Angelo to Breckenridge, Tex.

* * *

DR. GEORGE F. KAY, head of the geological department of the University of Iowa and state geologist of Iowa, with MRS. KAY spent a brief vacation in San Antonio, Tex.

* * *

HARRY BENGE CROZIER, who has been director of public relations for the American Petroleum Institute, has resigned as of May 1 and returned to the staff of the Dallas Morning News, Dallas, Tex.

* * *

CHARLES MALI CLAYES, manager of the Paris branch, and SIGURD HALLAGER, manager of the Stockholm branch of the Texas Company, arrived in New York last week on the Ile de France of the French line.

* * *

FRANK BROWN, foreign representative of the Hughes Tool Company, Houston, Tex., has arrived in the United States after spending one year visiting foreign oil fields including Russia. He will attend the International Oil Exposition and Congress at Tulsa.

* * *

CHARLES F. BALPH, formerly of Ponca City, Okla.; W. R. GAHRING, of Shawnee, Okla., formerly district geologist of the Continental Oil Company for the Seminole district, and M. H. McCLELLAN, have opened offices in the Masonic Building in Shawnee for consulting work.

* * *

COL. E. F. SIMMS, of Kentucky and Houston, Tex., spent the past week in Houston on business.

* * *

L. S. CANNON, general control chemist, has returned from a trip through Continental Oil Company's New Mexico refineries.

* * *

J. T. KIRBY, secretary-treasurer of the Republic Petroleum Company, was re-elected at the annual meeting held in Los Angeles, Calif., recently.

* * *

ERNEST H. CORNELIUS, president of Oklahoma Steel Castings Corporation, who suffered a relapse after undergoing an appendectomy in a Cleveland, Ohio, hospital, is reported recovering.

* * *

FRANK GOWER, of the land and lease department of the Denver, Colo., offices of the Texas Company, was in Casper, Wyo., making an extensive survey of holdings of the Texas Production Company in Wyoming.

* * *

W. F. HUMPHREY, of the Tide Water Associated Oil Company, arrived in Los Angeles, Calif., a week or so ago to participate in the discussions regarding the marketing agreement which has been under consideration for the past several weeks.

* * *

K. R. KINGSBURY, president of the Standard Oil Company of California, and GEORGE LEGH-JONES, president of the Shell Oil Company of California, have returned to San Francisco following an extended stay in Los Angeles where marketers have been in conference for some time in connection with the marketing agreement.

DO YOU REMEMBER?

From The Oil and Gas Journal Files

25 Years Ago

May 10, 1909

The Prairie Oil & Gas Co. has asked the Department of the Interior for a modification of pipe line regulations with a view of constructing a pipe line from Muskogee, Okla., to Baton Rouge, La.

James Britton, son of Col. A. M. Britton, of the Britton-Johnson Oil Co., dies in New York.

The Standard Oil Co. of New Jersey and all its subsidiary companies produce only 9 per cent of the oil in the United States. It is mainly a refiner and marketer and in these fields it dominates.

20 Years Ago

May 14, 1914

The Prairie Oil & Gas Co. has 44,483,000 bbls. of crude oil in storage and is adding to it daily because of overproduction in Cushing, Oklahoma.

C. J. Wrightsman, Tulsa oil producer, leaves for Washington, D. C. While there he will ask the Bureau of Mines to establish an oil statistical bureau to gather first hand oil information.

While Mr. and Mrs. Sam Travis, of Tulsa, were visiting in Paris, a daughter was born to them on Sunday, May 10.

Gunsburg & Forman pay $150,000 for 8 acres of undeveloped acreage in the SW Section 9-17-7, Cushing Field, Oklahoma.

George S. Bole, of Robinson, Ill., is in Tulsa looking over the Mid-Continent situation.

Oklahoma averaged 236,000 bbls. per day production last week, its high record thus far.

10 Years Ago

May 8, 1924

Luling, in Southwest Texas, is the largest producing pool in the Coastal or Southwest Texas fields. It is producing 23,100 bbls. per day. Hull is second with 21,000 bbls.

C. B. Peters, head of the Peters Oil Co., is moving the company's headquarters from New York to Tulsa.

The average price of 20 representative petroleum stocks on the New York Stock Exchange is $49.59 per share.

K. C. Heald has resigned from the U. S. Geological Survey to join the faculty of Yale University of which he is a graduate.

HARRY PENNINGTON, of San Antonio, Tex., was in Houston, Tex., during the past week on business.

* * *

W. C. HOLLIMAN, formerly of Shell Petroleum Corporation, has joined the Bureau of Mines chemical research staff.

* * *

JAMES CREEDEN, superintendent for the Skelly Oil Company at Wink, Tex., has returned from a business trip to Tulsa.

* * *

DANIEL A. HART, works manager of Alexander Duckham & Company, Ltd., London, England, has been elected to the board of directors.

* * *

J. J. STADTHERR has been promoted to assistant to the chief chemist, H. G. HODGE, at the Sinclair laboratory at Coffeyville, Kans.

* * *

SAMUEL P. WALLACE, district manager for the Parkersburg Rig & Reel Company, at Dallas, Tex., spent a few days in Tulsa during the past week.

* * *

JOHN R. MILLER, chief geologist of the South Texas division for the Texas Company in Houston, Tex., spent several days the past week in San Antonio, Tex.

* * *

COMMENDATORE EDGARDO BAZZINI, managing director of the Azienda Generale Italiana Petroli, has been elevated to the rank of Grand Officer of the Crown of Italy.

* * *

R. L. MINCKLER, General Petroleum Corporation, discussed budget procedure at the monthly meeting of the Los Angeles Petroleum Accountants Society, Los Angeles, Calif.

* * *

O. J. THOMPSON, manager of the Charles N. Hough Manufacturing Company, Franklin, Pa., is spending some time in Tulsa.

* * *

GENTRY KIDD, geologist for the Stanolind Oil & Gas Company, Midland, Tex., is recuperating from an appendicitis operation in a hospital in that city.

* * *

R. L. WHEELOCK, North Texas independent operator, and president of the Texas Petroleum Council, was in Houston, Tex., the past week where he presided over the meeting of the petroleum council held at the Texas State Hotel last Friday.

* * *

A. L. RUSHING, who has been working in the production department for the Pure Oil Company at Van, Tex., has returned to the scouting department and will cover Southeast New Mexico. His headquarters will be at Odessa, Tex.

* * *

MISS FLORENCE LUNDELL, librarian, technical department, Tulsa Public Library, Tulsa, was elected president of the Oklahoma Library Association at the annual meeting held in Ponca City last week, succeeding MRS. GERTRUDE K. STERBA, of Ponca City, Okla.

* * *

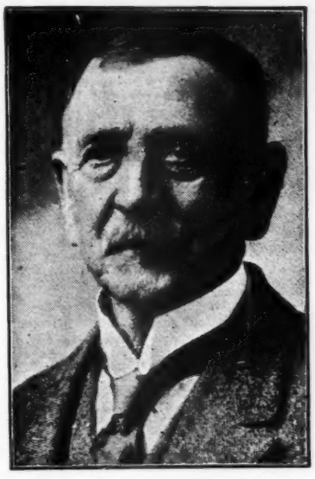
PAUL DUMANOIS, head of the technical services of the Office National des Combustibles Liquides and Inspector-General of Aeronautics, has been appointed by the French government to be director of aircraft construction at the central administration of the Air Ministry.

* * *

J. A. NICHOLS, JR., who has been assistant division land man at Fort Worth, Tex., for the Texas Company, has been transferred to Wichita Falls, Tex., to a similar position. R. E. WITTY, formerly located at Midland, Tex., has been moved to Fort Worth and made assistant in charge of the land department there. FORD HUBBARD, combination scout and lease man at Cisco, Tex., with the company, has been transferred to Midland in charge of the land department in that office. C. J. GEORGE, formerly in West Texas, succeeds Mr. Hubbard at Cisco, as scout and lease man.

Canadian Oil Man Is Active at 92

James Peat, the oldest citizen of Petrolia, Ontario, and the oldest oil operator in Canada, celebrated his ninety-second birthday on April 9, 1934. Born near Glasgow, Scotland, in 1842, Mr. Peat was taken to to Canada with his parents the same year. Brought up on a pioneer Ontario farm, as a 10-year-old boy he carried mail on horseback through the woods. A horse fell on him, fracturing one of his legs. This accident resulted in his turning his attention to study and ultimately becoming a teacher. In 1866 he prospected for gold in Hastings County, Ontario, but shortly afterward the newly developed petroleum industry attracted him to Pennsylvania, where he learned the driller's trade.



JAMES PEAT

Mr. Peat went to the Petrolia Field in 1870, taking with him the first cable-tool rig ever used in Canada. Much of western Ontario was still a heavily timbered and swampy wilderness. As a drilling contractor and oil operator he became widely known, his tests covering territory from Portland, Me., to the Queen Charlotte Islands on the Pacific Coast. He drilled in Cuba after the Spanish-American War and put down numerous wildcat tests in both eastern and western Canada.

Always an active and energetic man, Mr. Peat at 92 still takes a deep interest in the oil industry and in public affairs. He was made honorary president of the Petrolia Old Home Week held several years ago; and in November, 1931, he was the guest of honor at the diamond jubilee of Washington Lodge, A.F.&A.M., of Petrolia, he being the only surviving charter member of the Masonic lodge formed in 1871.

BRUCE BEATON, pipe line scout for the Stanolind Crude Oil Purchasing Company, has been transferred from Tyler, East Texas, to Oklahoma.

* * *

WILFRED E. GOODAY, chief of the industrial technical department of the Vacuum Oil Company, has been elected to the Council of the Institution of Petroleum Technologists, the first original student to obtain membership of the council.

* * *

MAX HILL has been transferred from Craig, Colo., to Midwest, Wyo., by the Stanolind Oil & Gas Company. He had charge of the loading and shipping of crude oil at Craig for the Stanolind. He is succeeded in Craig by W. H. SAPINGTON, of Midwest.

* * *

R. T. EASTELL, of Pittsburgh, Pa., president of the Washington Oil Company, and G. C. JOLLY, superintendent, are in Tulsa, guests of W. T. FUNK, former vice president of the Carter Oil Company, now retired. The Washington Oil Company is one of the oldest producing companies in southwestern Pennsylvania, and Mr. Jolly has been associated with it for more than 45 years.

* * *

W. T. TOUCHTON, president, Diamond Metal Company, Houston, Tex., returned late in May from a 10-day trip to New York City, where he drove, with MRS. TOUCHTON, on business concerning his company's foreign trade which is handled by Oilfield Equipment Company, New York. Plans were completed by Mr. Touchton and T. E. WARD, president, Oilfield Equipment Company, for expanding in foreign oil fields.

* * *

G. A. McWHIRTER has been placed in charge of the Texas Railroad Commission office and force at Wichita Falls. The district is known as No. 9 and is composed of Archer, Clay, Cooke, Baylor, Jack, Foard, Montague, Wichita, Wilbarger, Haskell, Young, Throckmorton and Knox Counties. Drilling permits for Cooke County must be obtained in Dallas in the future, and those for Stephens County secured at Eastland. The offices of the commission at Olney have been closed.

A. J. MILLER, of San Antonio, Tex., independent operator, was spending the latter part of the week in Houston, Tex., on business.

* * *

C. H. LANE, president of the Southern Sulphur Company, now located in New Orleans, La., spent the past week in Houston, Tex., on business.

* * *

R. V. EVRIDGE, of the Rancho Oil Company, Fort Worth, Tex., has been spending some time looking over properties in the Wichita Falls district.

* * *

M. J. DELANEY, drilling contractor of Dallas, Tex., is spending considerable time in the Gulf Coast where he now has a rig running at Goose Creek.

* * *

BILL EYSSEN, independent operator of Houston, Tex., who has been operating in East Texas, was seriously injured in an automobile accident near Dallas.

* * *

J. R. B. MOORE, of Houston, Tex., formerly vice president of Windsor Oil Company, has left the company and will operate independently on the Gulf Coast.

* * *

J. M. McINTIRE and EARL G. BURWELL, of the New York Oil Company offices in Casper, Wyo., have returned after attending a meeting of the Midwestern Gas Association at Sioux City, Iowa.

* * *

R. MacGILLAVRY has resigned from his position of head representative of De Bataafsche Petroleum Maatschappij, Handelszaken, the marketing organization of the Royal Dutch-Shell for the Dutch East Indies. Mr. MacGillavry has had 27 years' service with the company.

* * *

P. M. GRIFFITHS, refinery superintendent of the Minatitlan refinery of the Mexican Eagle Oil Company, has arrived in England on a three months' vacation.

* * *

GRAYDON H. LAUGHBAUM has been appointed division geologist for the Sinclair Prairie Oil Company at Oklahoma City, Okla., with MIKE HAMILTON as assistant.

* * *

A. BEEBY THOMPSON, petroleum consultant and engineer, has returned to London, England, from a visit to the properties of Mosul Oilfields, Ltd., in Iraq. He also visited the oil regions near Vienna and certain areas in Rumania.

* * *

HENRY WAECHTER, of Seattle, Wash., paid a visit to the Cut Bank Field in northern Montana, early in the month. Mr. Waechter is an executive of the Two Medicine Oil & Gas Company, which recently started a wildcat on the Hagan structure, southwest of Cut Bank.

* * *

E. L. DeGOLYER, of Montclair, N. J., formerly president and later chairman of the board of the Amerada Petroleum Corporation, and WALLACE E. PRATT, of Houston, Tex., vice president and director in charge of the land and geological departments of Humble Oil & Refining Company, are making a 10-day stay on the latter's ranch in the McKittrick Canyon in Culberson County, Texas.

* * *

TUDOR H. A. TIEDEMANN has been made executive head of the Industrial Relations Counselors, Inc. For 15 years Mr. Tiedemann was assistant to C. J. HICKS in the industrial relations department of the Standard Oil Company of New Jersey. Industrial Relations Counselors was established in 1926 with the support of JOHN D. ROCKEFELLER, JR., devoted to research in the general field of human relations in industry. Mr. Hicks has been associated with the Industrial Relations Counselors since his retirement from the New Jersey company last July, and will continue on its executive committee.

XUM

Gulf Coast Fields and Wildcats

(Continued from Page 183)

Sun Oil Co.'s No. 9 Chambers Co., 181 ft. W of No. 8 and 50 ft. from N line of lease ..... Rigging up.
Sun Oil Co.'s No. 5 Higgins, 125 ft. W of No. 4 ..... Derrick.
Sun Oil Co.'s No. 15 Wilburn, 405 ft. from E, 50 ft. from W line ..... T.D. 5,090 ft.; show oil; comp. 360 bbls. day, ¾-in. choke, T.P. 100 lbs., C.P. 680 lbs.

Sun Oil Co.'s No. 16 Wilburn fee, 120 ft. W of No. 15 and 40 ft. from N line of 20-acre tract in William Hodges Sur. ..... Drlg. shale and lime 3,759 ft.

Sun Oil Co.'s No. 18 J. Wilburn, Henry Griffith League, 50 ft. N of S line, 50 ft. E of W line of lease ..... T.D. sand 5,130 ft.; W.O.C.
Sun Oil Co.'s No. 21 J. Wilburn, Wm. Hodges Sur., 50 ft. N of No. 20 ..... Drlg. sand 3,724 ft.; slight show oil; T.S. 3,703 ft.

Texas Co.'s No. 8 Wilburn, 25 ft. W of No. 5 and 50 ft. N of S line in the Henry Griffith League ..... O.T.D. 4,974 ft.; cut and pulled tubing 4,722 ft.

Texas Gulf Prod. Co.'s No. 3 Barber, 514 ft. W, 41 ft. S of NE cor. of lease, Henry Griffith League ..... Drlg. sand and lime 3,934 ft.
Texas Gulf Prod. Co.'s No. 8 A. E. Barber, 400 ft. S of N line and 50 ft. E of W line of lease ..... Rigging up.
Texas Gulf Prod. Co.'s No. 2 Fitzgerald, 300 ft. from W and 30 ft. from S line of lease ..... Drlg. shale and lime 4,972 ft.
Texas Gulf Prod. Co.'s No. 8-H Kirby, 333 ft. W of No. 6-H, 70 ft. N of S line, Henry Griffith League (W.O.) ..... **T.D. 5,024 ft.; sidetracked at 3,179-5,022 ft.; shot drill pipe at 2,750 ft.;** temp. abnd.

Texas Gulf Prod. Co.'s No. 4 Wilburn, Wm. Hodges Sur., 330 ft. N of S line, 50 ft. W of E line ..... T.D. 4,881 ft.; cmtd. 3,782 ft.
Yount Lee Oil Co.'s No. 23 Chambers County, Wm. Bloodgood Sur., 116.9 ft. S of N line and 247 ft. W of E line ..... T.D. 4,310 ft., sand; preparing to set screen.

Yount Lee Oil Co.'s No. 24 Chambers County, 400 ft. W of No. 23 in line with No. 21 ..... Derrick.
Yount Lee Oil Co.'s No. 8 Phillips, Wm. Hodges Sur. .... T.D. 996 ft.; preparing to set 16-in. O.D. csg.

RABBS RIDGE—FORT BEND COUNTY

Humble O. & R. Co.'s No. 21-A F. J. Booth ..... Drlg. shale 1,833 ft.
Humble O. & R. Co.'s No. 26-A Lockwood & Sharp, 755 ft. N and 14 ft. W of No. 26-B, in J. Rabb Sur. .... Location.
Humble O. & R. Co.'s No. 27-A Lockwood & Sharp, 1,149 ft. W of No. 26-A and 755 ft. W of No. 27-B in J. Rabb Sur. ..... Location.
Humble O. & R. Co.'s No. 27-B Lockwood & Sharp, 1,153 ft. W of No. 26, J. Rabb Sur. ..... Drlg. shale 3,648 ft.
Naylor's No. 4 S. B. Gehr, 1,260 ft. from W line and 330 ft. from S line of lease in Samuel Kennedy Sur. ..... T.D. 5,406 ft.; set screen; wouldn't flow; S.D. orders.

LONG POINT—FORT BEND COUNTY

Oleson et al's No. 1 McFarland ..... Cutting and pulling screen; T.D. 1,002 ft.

ORCHARD—FORT BEND COUNTY

Gulf Prod. Co.'s No. 39 Moore ..... Drlg. sand 3,166 ft.

SUGARLAND—FORT BEND COUNTY

De Walt Oil Co.'s No. 1 Peterson ..... Top salt 4,512 ft.; T.D. 4,514 ft.; P.B. 3,300 ft.; drlg. sandy shale 4,262 ft.

HIGH ISLAND—GALVESTON COUNTY

D. E. M. Oil Co.'s No. 1 Great Western ..... T.D. 149 ft. in rock; pumping 7½ bbls. hour.
Yount Lee Oil Co.'s No. 4 Broussary & Orme, M. Dunman Sur., 129 ft. SW of No. 3 ..... Top salt 4,565 ft.; T.D. shale and pyrite 5,358 ft.; stuck drill stem.
Yount Lee Oil Co.'s No. 41 Cade, Fitzsimmons Sur. ..... Rigging up.
Yount Lee Oil Co.'s No. 40 Cade, 430 ft. NW of No. 2-B, 360 ft. from E line of lease and in line with No. 39 and No. 2-B, Fitzsimmons Sur. ..... Drlg. hard sand and lime 2,814 ft.
Yount Lee Oil Co.'s No. 2 Mathis, M. Dunman Sur., direct offset No. 1 Spencer ..... Drlg. salt 3,631 ft.
Yount Lee Oil Co.'s No. 12 Smith, 330 ft. W of No. 11 and 100 ft. N of No. 2 ..... Drlg. salt and lime 4,989 ft.
Yount Lee Oil Co.'s No. 22 Smith ..... Derrick.

ARRIOLA—HARDIN COUNTY

Republic-Houston's No. 2-X Arriola fee ..... Drlg. shale 5,802 ft.
Republic-Houston's No. 7 Arriola fee ..... D.S. test from 4,688-97 ft.; showed 25 thribbles oil, 5 min., 90 lbs. pressure; T.D. 4,697 ft.; comp. 950 bbls., 17 hrs., ½-in. choke, T.P. 450 lbs., C.P. 1,000 lbs., 38.6 gravity.

BATSON—HARDIN COUNTY

Danciger O. & R. Co.'s No. 2 Hooks, W. Donoho Sur., 330 ft. E of CWL, Blk. 24 ..... T.D. 4,795 ft.; flowed salt water; P.B. 4,783 ft.; W.O.C.

SARATOGA—HARDIN COUNTY

Rio Bravo Oil Co.'s No. 108 Jordit, 120 ft. S and 150 ft. W of No. 98 well ..... T.D. 986 ft.; set screen; bailing.
Seismo Oil Co.'s No. 1 Casewell, 940 ft. S of NW cor. and 600 ft. from E line, B.B.B.&C. Sur. ..... T.D. 3,212 ft.; shut down.
Skinner Oil Co.'s No. 3 Sessler ..... Drlg. gumbo 1,765 ft.

SOUR LAKE—HARDIN COUNTY

Parr et al's No. 1 Benard, in W.C.R.R. Sur. No. 69 (west edge) ..... Coring sand and shale 6,999 ft.
Steinberger Pet. Co.'s No. 1 Weiss, 150 ft. W of Parr No. 1 and 50 ft. out of SE cor. of Blk. 28, E. B. Williams Sur. ..... Location.

FRANCIS, BRO. & Co.

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New York Curb "Associate"
New York Cotton Exchange
N. Y. Coffee & Sugar Exchange
Chicago Stock Exchange
Chicago Board of Trade
St. Louis Stock Exchange
St. Louis Merchants Exchange

Fourth and Olive Streets
ST. LOUIS

Kennedy Building
TULSA

Direct Private Wires

Yount Lee Oil Co.'s No. 6 Lynn, 250 ft. from W line and 200 ft. from N line of 43-acre tract in Sour Lake Oil Co. Sub. ..... T.D. 1,099 ft.; W.O.C. ¾

GOOSE CREEK—HARRIS COUNTY

Edwards Drlg. Co.'s No. 1 Matthews, 40 ft. from S line and 37 ft. from W line of 1-acre tract in Wm. Scott Sur. No. 67 ..... Drlg. 2,731 ft.
Gulf Prod. Co.'s No. 13 St. Land Prod., 39 ft. from E line or 89.4 ft. W of Sun Oil Co.'s No. 1 McFarland, Wm. Scott Sur. No. 67 ..... T.D. 4,605 ft.; preparing to set screen.
Gulf Prod. Co.'s No. 18-A Tabb-fee, 217 ft. S of No. 17-A and C of tract in Wm. Scott Sur. ..... Drlg. shale 655 ft.
Gulf Prod. Co.'s No. 23-A Wright, 50 ft. from N and W lines of NW cor. of Lot 8, A. A. Wright Subd., Wm. Scott Sur. No. 65 ..... T.D. 4,014 ft.; comp. 209 bbls. daily, 36 per cent S.W.
Hamil & Smith's No. 1 Chapman & Bryan (workover) .. Coring 4,770 ft.
Hoffner & Moore's No. 1 A. A. Wright, 50 ft. N and 50 ft. E of SW cor. of Blk. 7, Wm. Scott Sur., Abst. No. 65 ..... Drlg. shale 5,221 ft.
Humble O. & R. Co.'s No. 80 Simms-Smith ..... Driving piling.
Humble O. & R. Co.'s No. 27 Sweet, 37 ft. W of SE cor. of Hughes 7½-acre tract and 40 ft. from N line of lease, Wm. Scott Sur. No. 67 ..... Drlg. shale 1,132 ft.
Humble O. & R. Co.'s No. 28 Sweet, 13 ft. W of SE cor. of Scott 2½-acre tract and 53 ft. from N line of lease, Wm. Scott Sur. No. 67 ..... Location.
Mirimar Oil Co.'s No. 2 Hughes, 284 ft. from S line and 50 ft. from E line of 7½-acre tract in Wm. Scott Sur. ..... Drlg. 3,200 ft.
L. H. Puckett's No. 1 Scott, Wm. Scott Low League, 35 ft. from E line and 45 ft. from S line of 2½-acre tract ..... Set 7-in. at 3,915 ft.; T.D. 4,026 ft.; comp. 31 bbls. day, ½-in. choke.
Jay Simmon's No. 1 Kerwin Mitchell, SE cor. of 6-acre tract ..... Set surface csg.
Wilhite's No. 1 Gillette ..... Derrick.
Wilhite's No. 1 Isenhour ..... Rigging up.

HUMBLE—HARRIS COUNTY

Rio Bravo Oil Corp.'s No. 8 fee, 250 ft. E, 100 ft. S of No. 2 fee ..... Rigging up.
Texas Co.'s No. 47 Stevenson, J. B. Stevenson Sur., 859 ft. E, 457 ft. S of NW cor., Lot 1-A ..... T.D. 5,338 ft.; W.O.C.

PIERCE JUNCTION—HARRIS COUNTY

Harris & Smith's No. 1 Gulf fee, 4-acre tract in W. H. Jones Subd. ..... Set surface csg.
Rio Bravo Oil Corp.'s No. 9-A Settegast, 1,575 ft. N line, 350 ft. E line NE cor. "A" lease, J. A. Kopman Sur. .. T.D. 4,510 ft.; rigging up to work over; standing.
Rio Bravo Oil Corp.'s No. 12-A Settegast, 1,410 ft. N line, 650 ft. E line, J. A. Kopman Sur. ..... T.D. 5,404 ft.; preparing to work over.
Rio Bravo Oil Co.'s No. 24-A Settegast, J. Kopman Sur. No. 44, 1,000 ft. S, 200 ft. W of NE cor. of "A" lease. Drlg. shale 4,781 ft.

TOMBALL—HARRIS COUNTY

Amerada-Rycade's No. 1 Ashley, 500 ft. E and 466 ft. S of Ashley tract in Joseph House Sur. ..... Derrick.
Amerada and Stanolind's No. 3 Fletcher, 464 ft. from W line and 466 ft. from N line of lease in J. House Sur. No. 34 ..... Drlg. shale 3,102 ft.
Humble O. & R. Co.'s No. 1 Johlke, 466 ft. from S line and 300 ft. from E line of 50-acre tract in J. H. Edwards Sur. ..... 10-in. at 951 ft.; drlg. shale 4,152 ft.

Humble O. & R. Co.'s No. 1 C. F. Hoffman, 1,900 ft. from S line and 466 ft. from E line of 123-acre tract, I.&G.N. Sur. No. 952 ..... Drlg. shale 2,925 ft.
Humble O. & R. Co.'s No. 2 C. F. Hoffman, 466 ft. E of most easterly W line and 466 ft. N of most northerly S line of 100-acre lease in J. House Sur. ... Drlg. shale 5,540 ft.
Humble O. & R. Co.'s No. 2-A J. F. W. Kobs, 1,062 ft. from N and 623 ft. from W line of lease in J. M. Hooper Sur. ..... T.D. 5,565 ft.; comp. 18 bbls. hour, ¼-in. choke.

Humble-Magnolia's No. 3 Theo. Krug, 6,360 ft. N of most southerly S line and 235 ft. W of W line of Scherer 112-acre tract in J. H. Edward Sur. No. 20.. Rigging up.
Humble O. & R. Co.'s No. 2 J. W. H. Martens, Wm. Hard Sur. No. 377 ..... T.D. 5,594 ft.; comp. 15 bbls. hour, ¼-in. choke; T.P. 1,550 ft.

Humble O. & R. Co.'s No. 3 Reid, 466 ft. N of S line and 466 ft. W of E line of lease in Goodrich Sur. No. A-305 ..... T.D. 5,553 ft.; W.O.C.
Humble & Magnolia's No. 2 Rudel-Oster, 150 ft. S of Amerada & Stanolind's No. 2 Fletcher, half way between E and W lines of 50-acre tract in J. House Sur. No. 34 ..... Location.
Humble & Magnolia's No. 1 H. Theak, 200 ft. from E line and 2,500 ft. from S line of 180-acre tract in Wm. Hurd Sur. ..... Drlg. shale 978 ft.
Shell Pet. Co.'s No. 1 W. W. Baker, 440 ft. S of C of N line of lease, J. House Sur. No. 34 ..... Location.
Shell Pet. Co.'s No. 2 W. W. Baker, 630 ft. S of No. 1 and 466 ft. from W line of lease, J. House Sur. No. 34 ..... Location.
Skelly Oil Co.'s No. 1 Schultz, J. H. Edwards Sur., 466 ft. from S line, 404 ft. from E and W lines .... Rigging up.
Texas Co.'s No. 2 Hirsch, 1,000 ft. E of W line and 350 ft. N of S line of lease in J. House Sur. ..... Drlg. shale 5,102 ft.
Texas Co.'s No. 2 Scherer (W. V. Bowles), 2,150 ft. S and 466 ft. W of NE cor. of lease in J. House Sur... Elev. 212 ft.; location.

ESPERSON—LIBERTY COUNTY

Cranfill-Reynolds Co.'s No. 20 Esperson, C. W. Fisher Sur., 471 ft. W line, 510 ft. N of No. 5 Esperson in "A" lease ..... T.D. 3,082 ft.; pumping 45 bbls. day.
General Crude Oil Co.'s No. 7 Davis, 100 ft. S of No. 4 in David L. Kokernut Sur. ..... T.D. 4,556 ft.; preparing to work over.
General Crude Oil Co.'s No. 8 Davis, 660 ft. from S and 1,000 ft. from E line of lease in D. Kokernut Sur.... Location.

HULL—LIBERTY COUNTY

Bashara Oil Co.'s No. 1 Hannah, Jessie De Vore Sur., 125 ft. E of Texas Co.'s No. 1 Hannah, 50 ft. N of S line ..... T.D. 4,475 ft.; P.B. 3,600 ft.; preparing to abandon.
Eclipse's No. 4 Barrow ..... Preparing to work over.
W. B. Flynn's No. 14 Abel, 90 ft. from N line and 150 ft. from E line of 10-acre tract in J. Devore Sur..... Standing 605 ft., shale.
Gulf Prod. Co.'s No. 100 Phoenix, 488 ft. from W line and 155 ft. N of Mirimar lease in E. G. Devore Sur. ..... Moving in rig.
Gulf Prod. Co.'s No. 99 Phoenix, 100 ft. N and W of NE cor. of Mirimar's 25-acre tract ..... Drlg. rock 1,805 ft.
Houston Oil Co.'s No. 8 Orgain, 156 ft. W of No. 5 and 132 ft. S of No. 7 in J. Devore Sur. ..... Drlg. sand and shale 4,720 ft.
Mirimar Oil Co.'s No. 10-A Phoenix, 250 ft. E of No. 3 and 100 ft. from N line of lease in J. Devore Sur. ... Drlg. 1,788 ft.
Mirimar Oil Corp.'s No. 4-B Phoenix, 200 ft. E of No. 1 and 50 ft. from N line of lease in J. Devore Sur. ... Drlg. shale 3,118 ft.
Republic Prod. Co.'s No. 151 Dolbear, J. Devore Sur., 200 ft. E of No. 35 ..... Drlg. sand and shale 4,852 ft.
Sun Oil Co.'s No. 4-A Carr, 196 ft. due W of No. 3, 50 ft. from N line of lease ..... Drlg. 4,735 ft., shale.
Texas Co.'s No. 5 Barrow fee, 533 ft. S and 150 ft. W of NE cor. of lease in J. Devore Sur. ..... T.D. 4,955 ft.; comp. 12 bbls. hour.

LIBERTY COUNTY

Mrs. I. M. Lemon Oil Co.'s No. 1 Richardson, 120 ft. E of Gulf & Humble's No. 1 Carter, in M. G. White Sur. ..... T.D. 3,882 ft.; rerun tubing; standing.

CONROE—MONTGOMERY COUNTY

Alpha Pet. Co.'s No. 4 Stephens ..... Drlg. shale 5,102 ft.
Gulf Coast Drlg. & Prod. Co.'s No. 4 Bertrand ..... T.D. 5,132 ft.; comp. 510 bbls., ¼-in. choke.
Gulf Coast Drlg. & Prod. Co.'s No. 22 Keystone Mills, A. Steele Sur. ..... T.D. 5,070 ft.; W.O.C.
Harrison & Abercrombie's No. 6 Alexander, John McHorse Sur., 466 ft. from W line and 300 ft. from S line ..... T.D. 5,070 ft.; comp. 90 bbls. hour, ½-in. choke.
Houston-Tide Water Oil Co.'s No. 8 Cartwright, 1,263 ft. from S line and 2,034 ft. from W line of lease in John Davis Sur. ..... Derrick.
Houston-Tide Water Oil Co.'s No. 9 Cartwright, 1,263 ft. from S line and 1,200 ft. from W line of lease in John Davis Sur. ..... Drlg. 1,700 ft.
Humble O. & R. Co.'s No. 3 American Natl. Bank, 751 ft. from N and 308 ft. from E lines of lease, W. Strickland Sur. ..... T.D. 5,114 ft.; comp. 64 bbls. hour, ½-in. choke.
Humble O. & R. Co.'s No. 1-E Cartwright, E offset to Brown & Wheeler's No. 1 Gilbert, J. A. Davis Sur... Trying to bring in, 5,164 ft.; no pressure on tubing or casing.
Humble O. & R. Co.'s No. 23 Keystone Mills ..... Drlg. sand 5,108 ft.
Humble O. & R. Co.'s No. 30 Keystone Mills, A. Steel Sur. ..... Sand 5,125 ft.; comp. 69 bbls. hour, ½-in. choke.
Humble O. & R. Co.'s No. 1 McComb ..... Drlg. shale 981 ft.
Humble O. & R. Co.'s No. 47 Moore ..... Drlg. shale 5,105 ft.
Humble O. & R. Co.'s No. 51 Moore ..... Drlg. shale 1,998 ft.
Humble O. & R. Co.'s No. 4 Moorehead ..... Drlg. shale 2,126 ft.
Humble O. & R. Co.'s No. 63-A South Texas Development Co. ..... Drlg. shale 1,698 ft.
Strake Oil Co.'s No. 5 Keystone Mills ..... Drlg. shale 3,370 ft.
Texas Co.'s No. 13 Moody ..... T.D. 5,111 ft.; cutting and pulling screen.

PORT NECHES—ORANGE COUNTY

Texas Co.'s No. 2 Orange Natl. Bank, Jacob Beaumont Sur., 1,538 ft. W and 200 ft. S of NE cor. of lease .. Drlg. shale 5,760 ft.
Texas Co.'s No. 2-B Polk, 695 ft. N, 150 ft. S of NE cor. of N. Jacob Beaumont Sur. ..... T.D. 5,997 ft.; 50 ft. cmt. plug from 3,050-3,100 ft.; W.O.C.

LIVINGSTON—POLK COUNTY

Gist Oil Co.'s No. 1 Kingsbury County Holding Corp., A. Viesca Sur., 150 ft. N at R/A and 153 ft. E along S line of tract ..... T.D. 4,242 ft.; making 10 bbls. distillate hour.
Gem Oil Co.'s No. 4 Davis Holmes, 1,126 ft. from S line and 1,399 ft. from W line of 157-acre tract in A. Viesca Sur. ..... Set surface csg.
H. B. Owenby's No. 1 Kimes, 330 ft. from N line and 330 ft. from E line of 25-acre lease in A. Viesca Sur. ..... Drlg. shale 452 ft.
H. B. Owenby's No. 2 Kimes, 330 ft. from S and E lines of 35-acre tract, A. Viesca Sur. ..... T.D. 4,336 ft.; comp. 60 bbls. hour, ½-in. choke, T.P. 566 lbs., C.P. 900 lbs.
Reading & Bates' No. 2 Davis Holmes, 850 ft. from N line and 330 ft. from E line of lease in A. Viesca Sur. ..... Drlg. shale 520 ft.
Smith & McDaniel's No. 1 R. H. Jones, 380 ft. from N line and 500 ft. from E line of lease, A. Viesca Sur (8 offset to Humble's No. 2 Smith) ..... T.D. 4,285 ft.; D.S. test 4,243-69 ft. in 7½ min. through ¾-in. choke, 690 ft. oil, 30 ft. mud with 250 lbs. pressure; comp. 342 bbls., ¼-in. choke.
Smith & McDannald's No. 2 Munson Heirs, 575 ft. from E and 330 ft. from S edge 31.35-acre tract in Mary C. Swinney Sur. ..... Set surface csg. 460 ft.

GRETA—REFUGIO COUNTY

D. & D. Oil Co.'s No. 1 Fannie Heard, 330 ft. from N and E lines of Lot No. 14 ..... T.D. 3,639 ft.; installing jet.
Dash & Blanco's No. 1 J. M. O'Brien, Winfield Sur., 466 ft. from N and E lines of 300-acre tract ..... T.D. 4,396 ft.; 7-in. csg at 4,386 ft.; testing; W.O.C.
Fleboots Oil Corp.'s No. 1 M. C. Bauer, 330 ft. N line, 1,724 ft. from W line, J. M. Ximines Sur. ..... T.D. 3,487 ft.; flowing gas and S.W.; T.P. 325 lbs., C.P. 650 lbs.
Fleboots Oil Corp.'s No. 3-A J. F. Heard, Ximines Sur., 466 ft. from N line and 1,274 ft. from W line of 150-acre tract, 808 ft. E of No. 1 ..... T.D. 6,062 ft.; P.B. 1,640 ft.; to complete as gas well.
Fleboots Oil Co.'s No. 4-C J. M. O'Brien, 503 ft. from E line and 466 ft. from S line of Blk. 3, Peoples Sur... T.D. 316 ft.; W.O.C.
Hewitt & Dougherty's No. 3 Lambert, E. W. Harper Sur... T.D. 4,392 ft.; W.O.C.
Hewitt & Dougherty's No. 4 Lambert, 466 ft. from N line and 507 ft. from W line of Blk. 5, Hardwick Sur. ..... Rigging up.
Humble O. & R. Co.'s No. 2 Fannie Heard, 466 ft. S of most southerly N line and 303 ft. E of most westerly line in Crunk Sur. ..... T.D. 5,947 ft.; reaming.
Humble O. & R. Co.'s No. 4 Fannie Heard, 1,216 ft. from E line and 466 ft. from N line of lease in Ximines Sur. ..... Drlg. shale 1,239 ft.
Humble O. & R. Co.'s No. 4 J. F. B. Heard, 466 ft. from W line of 500-acre lease and 123 ft. NW of R.R. at right angles, or 2,750 ft. from W line and 3,710 ft. from line of Peoples Sur. ..... T.D. 4,386 ft.; setting csg.
Humble O. & R. Co.'s No. 2 Welder, 1,322 ft. from E line and 466 ft. from S line of 752-acre tract in the Winfield Sur. ..... Drlg. shale 6,000 ft.
Stanolind Oil & Gas Co.'s No. 3-A J. M. O'Brien, Peoples Sur., begin at NE cor. of "A" lease, thence W along N line 1,509 ft., thence S at right angles 466 ft., S offset to No. 4-B ..... S.D. 4,384 ft.
Stanolind Oil & Gas Co.'s No. 3-B J. M. O'Brien, Winfield Sur. ..... T.D. 4,393 ft.; W.O.C.
Stanolind Oil & Gas Co.'s No. 5-B J. M. O'Brien, S offset to No. 1 Welder ..... T.D. 4,390 ft.; comp. 4½ bbls. hour, open tubing.
Stanolind & Atlantic's No. 2-G J. M. O'Brien, 933 ft. N of No. 1, 315 ft. from E line of 400-acre tract in Winfield Sur. ..... T.D. 4,397 ft.; comp. 172 bbls. day, 3/16-in. choke; T.P. 350 lbs.
Stanolind Oil & Gas Co.'s No. 3 O'Connor, 1,620 ft. from S line and 466 ft. from W line of 100-acre lease in Crunk Sur. ..... T.D. 1,296 ft.; W.O.C.
Stanolind Oil & Gas Co.'s No. 4 O'Connor, 466 ft. from W and S lines of 100-acre lease in Crunk Sur. ..... S.D. 1,250 ft.
Texas Co.'s No. 1 James Welder, 2,700 ft. E and 466 ft. N of NW cor. of Continental's 200-acre Welder lease, John T. McGrew Sur. (N of Greta Pool) ..... Coring 3,438 ft.
United Prod. Co.'s No. 15 Fox, 830 ft. W of No. 2-A in Wm. Hews and L. Brown Sur. ..... Drlg. sand 4,737 ft.
United Prod. Co.'s No. 13 Fox, 933 ft. S of No. 12 and 466 ft. from E line of lease in Hews Sur. ..... T.D. 3,525 ft.; D.S. test 3,505-25 ft. showed 11 fourbles oil 10 min., 50 lbs. pressure; comp. 464 bbls. day, ¼-in. choke, T.P. 150 lbs.
United Prod. Co.'s No. 14 W. J. Fox et al, 466 ft. from N line and 1,060 ft. W of No. 11 on 848-acre tract in Wm. Hews and L. Brown Sur. ..... Drlg. shale and sand 3,577 ft.
United Prod. Co.'s No. 3 Lambert ..... Rigging up.
United Prod. Co.'s No. 8 Lambert ..... Derrick.

CALCASIEU LAKE—CAMERON PARISH

Texas Co.'s No. 10-A State, 16,855 ft. W and 3,270 ft. N of NE cor. Sec. 1-14s-9w in Twp. 13s-9w ..... Derrick.

CLAY CREEK—WASHINGTON COUNTY

Sun Oil Co.'s No. 3 Schermer, N. Clay Sur., 330 ft. NW, 330 ft. SW line of lease ..... Drlg. sandy shale 3,775 ft.
Sun Oil Co.'s No. 4 Schlettman ..... Oil sand 1,258 ft.; W.O.C.

SOUTH LOUISIANA FIELDS

BLACK BAYOU—CAMERON PARISH

Shell Pet. Corp.'s No. 3 State ..... Rigging up.
Shell Pet. Corp.'s No. 18 Watkins, 2,515 ft. S, 650 ft. W of NE cor. Sec. 18-12s-12w ..... T.D. 4,191 ft.; comp. 755 bbls. through 20/64-in. choke.

CAMERON MEADOWS—CAMERON PARISH

Burton-Sutton Oil Co.'s No. 1 School Land, 2,260 ft. W and 20 ft. N of SE cor. of Sec. 16-14s-13w ..... T.D. 4,410 ft.; to work over; S.D.
Burton-Sutton Oil Co.'s No. 3 School Land, 155 ft. N and 2,974 ft. E of SW cor. of Sec. 16-14s-13w ..... Drlg. sand 4,070 ft.
Humble O. & R. Co.'s No. 7 Cameron Meadows, 2,495 ft. W and 155 ft. S of NE cor. Sec. 16-14s-13w ..... T.D. 3,820 ft.; flowing in pits.
Humble O. & R. Co.'s No. 8 Cameron Meadows ..... Bldg. derrick.
Humble O. & R. Co.'s No. 1-B Cameron Meadows, 250 ft. W and 2,640 ft. S of NE cor. of Sec. 34-14s-14w... Drlg. 666 ft.
Texas Co.'s No. 1 Miami Corp. ..... Digging pits.

EDGERLY—CALCASIEU PARISH

Rex. Pet. Co.'s No. 13 Hunter, 466 ft. N, 90 ft. E of SW cor. of SE ¼ ..... T.D. 4,050 ft.; preparing to bail.
Union Sulphur Co.'s No. 1 La Prairie Narrone, 1,061 ft. N, 250 ft. W of SW cor. SW Sec. 21-9s-11w ..... Drlg. 6,135 ft.

FOUR ISLAND—TERREBONNE PARISH

Texas Co.'s No. 3 State, Four Island ..... Dredging canals.

GARDEN ISLAND—LAQUEMINES PARISH

Texas Co.'s No. 11 Garden Island, 4,191 ft. S and 1,504 ft. W of NE cor. Sec. 107-23s-32e ..... Drlg. 982 ft., shale.
Standard Oil Co. of Louisiana's No. 6 Myrtle Grove Wilbert, Sec. 52-9s-11e ..... Moving in rig.

GUEYDAN—VERMILLION PARISH

Pure Oil Co.'s No. 6 Alliance Trust, 667 ft. E, 1,787 ft. S line of lease, Sec. 34-11s-1w ..... Drlg. sticky shale and lime 5,998 ft.

HACKBERRY—CAMERON PARISH

Calcasieu Oil Co.'s No. 2 Hanszen, 400 ft. W and 200 ft. S of No. 1 in Sec. 14-12s-10w ..... T.D. 6,076 ft.; rigging up to work over; standing.
Gulf Ref. Co.'s No. 13-A Irwin ..... T.D. 7,320 ft.; set 22 ft. screen; comp. 1,500 bbls., ½-in. choke, 900 lbs. pressure.
Gulf Prod. Co.'s No. 14-A Irwin, 300 ft. SE of No. 13-A .. Rig.
Red Kelly Oil Co.'s No. 1 Duhon, 200 ft. S, 500 ft. E, NW cor. Sec. 27-12s-10w ..... T.D. 3,361 ft.; flowed 1,500 bbls. daily; stopped flowing; set tubing and screen; flowing 125 bbls. net oil, 60 per cent S.W.; comp.
Texas Co.'s No. 10-B State, 1,060 ft. E, 200 ft. N of NE cor. Sec. 13-12s-10w ..... T.D. 7,287 ft.; to bring in.
Texas Co.'s No. 12-B State, 500 ft. SE of No. 10-B or 1,360 ft. E and 149 ft. S of NE cor. of Sec. 13-12s-10w ..... Location.
Union Sulphur Co.'s No. 1 Barbee est., 1,720 ft. N line, 320 ft. E of SW cor. Sec. 12-12s-10w ..... T.D. 7,986 ft.; milling out 6,831 ft.
Union Sulphur Co.'s No. 7 Humble lease, 1,010 ft. N, 661 ft. E of SW cor. Sec. 12-12s-10w ..... T.D. 6,142 ft.; S.D.
Yount Lee Oil Co.'s No. 11 Gulf Land, Sec. 14-12s-10w .. Oil sand 6,089 ft., T.D.; cmtd. 7-in. csg.; W.O.C.
Yount Lee Oil Co.'s No. 14 Gulf Land ..... Drlg. shale 3,381 ft.

IOWA—CALCASIEU AND JEFF DAVIS PARISHES

Barnsdall Oil Co.'s No. 1 Caffal, 330 ft. N and E of SW cor. of lease ..... Coring lime 6,380 ft.
Barnsdall Oil Co.'s No. 5 Fontenot, 990 ft. N and 330 ft. W of SE cor. of SW of Sec. 7-9s-6w ..... Drlg. sandy shale 5,118 ft.
Magnolia Pet. Co.'s No. 6 Wait ..... Drlg. sand 4,557 ft.
Magnolia Pet. Co.'s No. 7 Wait ..... Shut down.
Magnolia Pet. Co.'s No. 8 Wait, 998 ft. W and 330 ft. N of SE cor. of 160-acre lease ..... Drlg. sand 130 ft.
Shell Pet. Corp.'s No. 2 Ardoin ..... Coring shells and shale 6,000 ft.
Shell Pet. Corp.'s No. 7 Heyd, 660 ft. out of NW cor. of lease, Sec. 13-9s-7w ..... Drlg. shale with streaks lime 5,711 ft.
Shell Pet. Corp.'s No. 8 Heyd ..... Drlg. sand 3,979 ft.
Shell Pet. Corp.'s No. 1 Tuter ..... Drlg. shale 6,572 ft.

JENNINGS—ACADIA PARISH

Heywood & Heywood's No. 4 Jennings fee, 900 ft. N and 280 ft. E of SW cor. of Sec. 49-9s-2w ..... T.D. 1,351 ft.; W.O.C.
Yount Lee Oil Co.'s No. 13 Houssiere-Latrielle, Sec. 47-9s-2w, 300 ft. E of No. 12 ..... Drlg. hard sand 7,298 ft.

LAKE BARRE—TERREBONNE PARISH

Texas Co.'s No. 10 L.L.&E., 4,643 ft. S, 503 ft. W of NW cor. Sec. 30-21s-20 ..... Drlg. anhydrite 3,469 ft.
Texas Co.'s No. 20 State-Lake Barre, Sec. 30-21s-20e .... Top salt 3,706 ft.; sand 3,732 ft.; comp. 1,733 bbls. day, ½-in. choke.
Texas Co.'s No. 28-A Lake Barre, 200 ft. SE from No. 17 in Sec. 29-21s-19e ..... Drlg. anhydrite 1,169 ft.
Diadem Oil Co.'s No. 1 Cenac ..... W.O.C. 702 ft.

LEESVILLE—LAFOURCHE PARISH

Emerald Pet. Corp.'s No. 2 State of La., Sec. 26-21s-22e.. Drlg. sand and gumbo 5,009 ft.
Emerald Pet. Corp., No. 5 State of La., 1,878 ft. N of No. 1 well in Sec. 26-21s-22e ..... Location.
Gulf Prod. Co.'s No. 2 Allen Land Co. ..... Drlg. gumbo 1,780 ft.
Gulf Prod. Co.'s No. 3 Bernard ..... T.D. sand 3,708 ft.; running csg.
Lincoln Oil Co.'s No. 1 Visier ..... Rigging up.
Texas Co.'s No. 11 L.L.&E., 2,921 ft. S, 1,560 ft. W of NE cor. Sec. 27-21s-22e ..... T.D. 4,043 ft.; W.O.C.

LOCKPORT—CALCASIEU PARISH

Magnolia Pet. Co.'s No. 7 Farquaher, 330 ft. S, 174 ft. W of NE cor. SW NE Sec. 8-10s-9w ..... Drlg. 6,347 ft.; no report.
Magnolia Pet. Co.'s No. 11 Bordages, 660 ft. N, 490 ft. W of SE cor. NE NE Sec. 8-10s-9w ..... T.D. 7,902 ft.; washing to bottom.
Magnolia Pet. Co.'s No. 19 Miller, Sec. 9-10s-9w ..... T.D. 4,434 ft.; swabbing.
Strake Oil Co.'s No. 1 Miller, 500 ft. due N of Yount Lee's No 1 Miller, Sec. 8-10s-9w ..... Clearing location.
Union Sulphur Co.'s No. 1 Farquaher, 200 ft. S and W lines, NE cor. SW SE Sec. 36-12s-10w, 2-ac. tract .. Tested salt water; S.D.; T.D. 7,468 ft.
Union Sulphur Co.'s No. 6 Moss, between Nos. 2 and No. 5 ..... Spudding.

PORT BARRE—ST. LANDRY PARISH

Texas Co.'s No. 17 Botney Bay, 1,800 ft. S 8 deg. W, 600 ft. N 82 deg. most southern NE 560 deg. tract, Sec. 4-6s-5e ..... Drlg. sand and gravel 381 ft.

STARKS—CALCASIEU PARISH

Union Sulphur Co.'s No. 5 Industrial Lbr. Co., 300 ft. S of No. 4, Sec. 30-9s-12w ..... Drlg. rock 4,114 ft.

SULPHUR—CALCASIEU PARISH

Union Sulphur Co.'s No. 788 fee, 602 ft. S, 1,309 ft. W of C Sec. 29-9s-10w ..... T.D. 6,103 ft.; set whipstock 2,660 ft.; W.O.C.
Union Sulphur Co.'s No. 790 fee, 929 ft. S and 802 ft. W of center of Sec. 29-9s-10w ..... Drlg. sand and shale 5,962 ft.
Union Sulphur Co.'s No. 791 fee, 529 ft. N, 907 ft. E of SW cor. Sec. 33-10s-12w ..... T.D. 5,607 ft.; set whipstock 2,608 ft.
Union Sulphur Co.'s No. 793 fee ..... Drlg. 2,970 ft., hard lime; set 9⅝-in. csg. 2,966 ft.

Union Sulphur Co.'s No. 794 fee ..... Drlg. sandy shale 1,543 ft.
Union Sulphur Co.'s No. 796 fee ..... Drlg. gumbo 770 ft.
Union Sulphur Co.'s No. 1 Bernard Ulrich, 75 ft. out of SW cor. Sec. 19-9s-10w ..... Drlg. salt 5,712 ft.

SWEET LAKE—CAMERON PARISH

Pure Oil Co.'s No. 12 Yount Lee fee, 600 ft. S of No. 11, in line with Nos. 9 and 10, Sec. 13-13-3w ..... Drlg. sandy shale 6,878 ft.

WHITE CASTLE—IBERVILLE PARISH

Shell Pet. Corp.'s No. 8 Wilbert, 717 ft. N 60 deg. 30 min. E from SE of Lot 2 of Fractional Sec. 9, in Sec. 1-11s-12e ..... Sand 4,573 ft.; S.D.

VINTON—CALCASIEU PARISH

Marrs-McLean's No. 16 Gray ..... Gumbo 2,877 ft.; S.D.
Tri-Oil Co.'s No. 1 Matilda Gray, 38 ft. W, 35 ft. N. of SE cor. NE SW NE Sec. 33-9s-12w ..... T.D. 3,535 ft.; preparing to run tubing.
Wilson Broach Co.'s No. 10 Wilson strip, 650 ft. N, 379 ft. E of SW cor. of SE of NE Sec. 33-10s-12w ..... T.D. 3,350 ft.; pumping 250 bbls. daily.
Wilson Broach Co.'s No. 11 Wilson strip (workover) ..... Sand 3,801 ft.
Vinton Pet. Co.'s No. 3 Gordon, Sec. 34-10s-12w, 209 ft. from S line, 50 ft. from W line of 2-ac. tract .. Shale 3,288 ft.; W.O.C.

MISCELLANEOUS WILDCATS

TEXAS

AUSTIN COUNTY

Gem Oil Co. and Johnson Bros.' No. 1 Haedge, 330 ft. out of Lot No. 1, Blk. 18, in San Felipe de Austin Sur. ..... Coring 5,665 ft.
Humble O. & R. Co.'s No. 1 Chelsey, 418 ft. from NW and 150 ft. from S line of 26-ac. tract in W. C. White Sur. ..... T.D. 4,047 ft.; comp. 392 bbls. day, ¼-in. choke, T.P. 440 lbs.
R. R. Mitchell's No. 1 H. Schleider, J. F. Fitzgibbons Sur., 300 ft. out NE cor. 98-ac. tract ..... T.D. 105 ft.; S.D.
Sun Oil Co.'s No. 1 Zetik, 662 ft. from N line and 1,509 ft. from W line of 104-acre tract in S. M. Williams Sur. ..... Drlg. 145 ft.

BRAZORIA COUNTY

Danciger O. & R. Co.'s No. 3-A Hunt, 2,100 ft. from E. 2,000 ft. from S lines of Hunt's 1,000-ac. tract in W. C. Carson Sur. ..... Drlg. sand, gas 6,736 ft.
Danciger Oil & Ref. Co.'s No. 1-B Hunt, 1,400 ft. from NW line and 1,750 ft. from NE line of 1,600-acre tract in W. C. Carson Sur. ..... Drlg. hard shale 6,752 ft.
Danciger Oil & Ref. Co.'s No. 1 Stark-Brown, 330 ft. out of most easterly NE cor. of lease in Perry & Austin Sur. ..... Drlg. sticky shale 3,515 ft.
Shell Pet. Corp.'s No. 2 Haury (Danbury), H.T.&B. R.R. Sur., 720 ft. SE of No. 1 Blakely-Winston ..... Drlg. shale 5,697 ft.

BRAZOS COUNTY

H. Elliott et al's No. 1 W. F. Odom, near center of 379-ac. tract in SW cor. of Isaac Curll Sur. ..... Cmtd. surface csg. 30 ft.
F. H. Scott's No. 1 Klintworth, I. Curd Sur., 300 ft. from N line, 400 ft. from E line ..... T.D. 2,026 ft.; S.D. for fuel.
D. W. Young, Jr.'s (H. L. Bleam) No. 1 Harrison, 300 ft. from S and W lines of lease in J. D. Allcorne Sur. ..... Spudding.

CALHOUN COUNTY

Continental Oil Co.'s No. 1 American Nat. Realty Co., C of NE of Sec. 6, Blk. C ..... Moving in rig.
Herman Heep Oil Co.'s No. 1 Welder, 7,500 ft. from W line of river ..... Drlg. shale 5,587 ft.

CHAMBERS COUNTY

John H. Carreker's No. 1 B. Weaver, 404 ft. out of SE cor. of lease in A. Weaver Sur. ..... Drlg. sand 2,056 ft.
J. E. Jones' No. 1 Canada-Smith Ranch, 356 ft. W and 330 ft. N of NE cor. of W. F. Gau 544-acre tract in J. S. Roberts Sur. ..... T.D. 6,612 ft.; stuck drill stem; lubricating.
Miramar Oil Co.'s No. 1 Geo. Stengler, V. Barrow Sur., 3,200 ft. from E line and center of N and S lines of lease ..... Drlg. 4,500 ft.

COLORADO COUNTY

Coyle-Concord Oil Co.'s No. 1 Nelson, 3,200 ft. SE of NW cor. of section, 2,200 ft. SW at right angles in I.&G.N. Sur. ..... T.D. 4,052 ft.; rigging up to deepen.
Union Central Oil Co.'s No. 1 Mann, 620 ft. from W line and 330 ft. from N line of 20-acre tract in J. L. Dugat Sur. ..... Location.

FAYETTE COUNTY

Berry & Hays' No. 1 Otto Steinhauser, 660 ft. from N and E lines of 75-acre tract in J. Schrader Sur. (4 miles SW of Muldoon) ..... Drlg. rock 1,834 ft.
Colorado Oil Co.'s No. 1 Anders ..... S.D. in gumbo 2,315 ft.

FORT BEND COUNTY

Edwards Drlg. Co.'s No. 1 H. Hausler, 780 ft. S of NE cor. of 103-acre tract, 510 ft. W of E line, Wickson Sur. ..... Drlg. 3,633 ft.; heaving shale.
Porter & Blanchard's No. 2 Wheat ..... Odor oil 2,528-33 ft.; T.S. 2,928 ft.; T.D. 2,967 ft.; set screen; making salt water and gas; S.D.

GALVESTON COUNTY

George K. Spoor's No. 1 Maco Stewart, 1,626 ft. N of SE cor. of Alex Farmer Sur. and 1,175 ft. E in W. K. Wilson Sur. (4 miles S of Dickinson) ..... Derrick.

GRIMES COUNTY

Clark & Dodd's No. 1 Murry, 150 ft. W line, 300 ft. S line, Anderson Sur. ..... Gumbo 1,305 ft.; no report.

HARDIN COUNTY

Greer & Frazier's No. 1 O. Sternberg, 660 ft. out of SW cor. of E 384 acres in H.&T.B. Sur. No. 283 ..... Drlg. sticky shale 5,667 ft.
Resource Oil Corp.'s No. 1 Sternberg Oil Co., C. of G. Dorsey No. 3 Sur., Abst. 193 ..... Derrick.

HARRIS COUNTY

Glenn H. McCarthy's No. 2 Preston on 80 ac. in Sec. 2, Blk. 9, 4 miles W of LaPorte ..... Location.
Golding & Murchison's No. 1 Clappert, W.C.R.R. Sur., Blk. 4, Sec. 9, 1,350 ft. from E line, 330 ft. from N line ..... T.D. 6,625 ft.; D.S. test open 27 min., ¼-in. choke, 12 thribbles mud and 9 thribbles S.W.
J. A. Hodges' No. 1 Scott, 200 ft. S, 900 ft. W of intersection of Crosby Huffman, F. Rankin Sur. ..... T.D. 6,275 ft.; S.D.
W. U. Paul's No. 1 E. M. House, 2,200 ft. N and 1,000 ft. E of NE cor. of E. Benson Sur. in M. Magruder Sur. ..... Derrick.
J. E. Seiber's No. 1 Tyrell & Gareth, 2,800 ft. from E line and 2,400 ft. from N line of survey, Lot 18, Blk. 20, Highland Subd., Ashbell Smith Sur. ..... Rigging up.

HOUSTON COUNTY

Murmac Oil Co.'s No. 1 G. L. Murray & Son, John Durst Sur. ..... Shale 3,436 ft.; S.D.

JACKSON COUNTY

Atkins & O'Neil's No. 1 Ward (Davis), C Lot 93, I.&G.N. Sur. No. 18, Blk. 3 ..... T.D. 6,250 ft.; reaming; D.S. test 5,944-57 ft., 3 min., 32 thribbles S.W., 2 thribbles mud, through ⅝-in. choke.
Encio Gas Co.'s No. 1 Toney, 150 ft. out of NW cor. of Toney's 1,064-ac. tract in Raymor Musquiz Sur. .. T.D. 5,582 ft.; D.S. test 5,523 ft., 7½ min., ¼-in. choke, 31 fourbles oil and 2 mud; 31.5 gravity oil.

JASPER COUNTY

Louis Franklin's No. 1 Cartwright, 360 varas E line and 740 varas S line of Lot 19, Edward Legrande Sur. ... Derrick.

JEFFERSON COUNTY

Lucky Strike Oil Co.'s No. 1 Walker, D. Easley Sur., 2,100 ft. N, 1,400 ft. E of NW cor. of Lot No. 13 .... S.D. 1,708 ft., shale and lime.
Sun Oil Co.'s No. 1 H. Long, 1,500 ft. N line, 990 ft. E line of lease ..... T.D. 7,138 ft.; stuck drill stem 3,500 ft.

LIBERTY COUNTY

Extension Oil Co.'s No. 1 J. A. Lovett, 200 ft. from E and 660 ft. from S line of lease, P. P. Deevers Sur... T.D. 1,565 ft., shale and sand; S.D.
Gulf Prod. Co.'s No. 2 Kirby, John Pleasants Sur., 1,866 ft. S of No. 1 ..... Drlg. brown shale 3,573 ft.
Gulf Prod. Co.'s No. 4-C Kirby, 7,100 ft. S and 1,383 ft. E of NW cor. of John Pleasant Sur. ..... Drlg. shale 5,403 ft.
Liberty & Independent Oil Co.'s No. 1 J. M. Neal, 3,550 varas from E line and 500 varas from N line of Samuel Strong Sur. ..... Derrick.
H. Sample's No. 1 Security Trust Co., 466 ft. from S and E lines of N 600 ac. of Lot 3 of H. Sample Subd. of J. Faulk Sur. ..... Spudding.
Seale's No. 1 Finley, 700 ft. E and 400 ft. N of SW cor. of 60-acre tract, A. B. Hardin Sur. ..... Derrick; aband.
Thomas et al's No. 1-A Eicke, 660 ft. from W line and 2,350 ft. from S line of tract in Green Sur. ..... T.D. 5,058 ft.; D.S. test 5,025 ft., ⅛-in. choke, 5 min., 8 thribbles mud.
Turnbull & Irwin et al's No. 1 N. Hildebrandt, W. Whitlock Sur., C of E ½ of survey ..... Drlg. 6,000 ft.

MADISON COUNTY

Paul Edwards et al's No. 1 Fulcher, 1,161 ft. from E line and 1,633 ft. from N line of Fulcher Sur. ..... Derrick.
Paul Edwards et al's No. 1 L. M. Peters, Mahala Wilkinson Sur., 400 ft. from N line and 300 ft. from W line of 132-acre tract ..... Shale 3,865 ft.; S.D.

MATAGORDA COUNTY

Dr. Griffith's No. 1 fee, 3,000 ft. from N line and 3,000 ft. from W line of Wm. E. Bell Sur. ..... Derrick.
Hamil & Smith's No. 2 Myers, 275 ft. W of No. 1 and 75 ft. S of creek in W. Haddon Sur. ..... T.D. 3,370 ft.; comp. 440 bbls. through 3/16-in. choke.
Oils Consolidated's No. 2 Hawkins, 200 ft. due NE of No. 1 well ..... T.D. 5,530 ft.; P.B. and coring 4,800 ft.
Skelly Oil Co.'s No. 1 Cobb, M. Cummins Sur., 434 ft. from E, 1,506 ft. S of F. G. Cobb's 167-ac. tract .... T.D. 7,186 ft.; P.B. to 7,076 ft.; 17/64-in. choke put on bottom of tubing; flowed 198 bbls. distillate 24 hrs.; S.D. for storage.
United North & South Dev. Co.'s No. 1 Unit 4, Buckeye farm, J. C. Keller league, 214 ft. N line and 202 ft. E line of lease ..... Drlg. sand and shale 7,848 ft.; show oil and gas.
United North & South Dev. Co.'s No. 1 Unit 6 (No. 2 Stoddard), 25 ft. each way out of NW cor. of Lot 19, Buckeye townsite ..... T.D. 9,457 ft.; circulating.
United North & South Dev. Co.'s No. 1 Unit No. 58, 250 ft. N and 300 ft. W of SE cor. of Unit No. 58 ..... Derrick.

MONTGOMERY COUNTY

Baker et al's No. 1 Benker, D. James Sur. ..... O.T.D. 4,921 ft.; side-tracked 3,523 ft.; two D.S. tests from 4,525-4,625 ft. failed.
Cooper & Smith's No. 1 Post, Daniel Roper Sur. ..... Cored lignite and sandy shale 2,823-27 ft.; S.D.
Deering & Frazier's No. 1 Hicks, 660 ft. S and W of NE cor. 565-acre tract, T. Taylor Sur. ..... Rigging up.
Hamill & Smith's No. 1 Foster Lbr. Co., Pryor Bryan Sur., 7,147 ft. from W line and 3,760 ft. from N line of lease ..... T.D. 6,310 ft.; abnd.
Humble O. & R. Co.'s No. 1 Texas Long Leaf Lumber Co., 466 ft. out of SE cor. of 2,000-acre tract in Walker County, S.L. Sur. ..... Bldg. road and clearing location.
McElroy Oil Corp.'s No. 1 Grogan Cochran Lbr. Co., 6,943 ft. from N line and 900 ft. from W line of 100-acre tract in P. V. Hamblin Sur. ..... Drlg. shale 3,840 ft.
Steen Drlg. Co.'s No. 1 Long Bell Lbr. Co., 440 ft. S and E from NW cor. of Wilson Barker Sur. ..... Top Cockfield 5,815 ft.; sand 5,867-69 ft., sand 5,873-77 ft.; D.S. test 5,855-77 ft. showed 350 lbs. pressure with 2 gals. dist. and 2 gals. mud in 4 min.; coring 5,981 ft.; D.S. test 5,873-84 ft., 575 lbs. pressure, 15 min., 1 joint brown dist., ¼-in. choke on top, ⅝-in. choke on bottom; D.S. test 6,016-52 ft.; showed 28 thribbles salt water, 11 min., 250 lbs.; sidetracked while running pipe; P.B. 2,380 ft.; drlg. shale 2,835 ft.

NEWTON COUNTY

Tide Water Oil Co.'s No. 1 Southwest Lbr. Co., 467 ft. S of most southerly N line and 1,664 ft. E of most westerly W line of 1,500-ac. tract in Henry Cochran Sur. ..... T.D. 5,848 ft.; abnd.

ORANGE COUNTY

Blue Line Oil Co.'s No. 1 Godwin, Richard Ballew Sur., 300 ft. from E line and 150 ft. from NE line of Godwin 20-acre tract ..... S.D. 900 ft.; bldg. road.
Texas Louisiana Oil Co.'s No. 1 Starks, 2,450 ft. N of NW cor. M. Delano Sur. 63, 10,500 ft. E at R/A .... Drlg. shale 3,192 ft.

REFUGIO COUNTY

C. B. Bunte's No. 1 Rook, 12,400 ft. from W and 11,500 ft. from N line of Antonio De Lavina Sur. ..... Derrick.
Cox et al's No. 1 F. W. Bissett, J. Crockett Sur. ..... Coring 3,659 ft.
Heard-Holland Oil Co.'s No. 1 Peck, 366 ft. N and W out of NW and SW of Bonnie View Subd. ..... T.D. 4,526 ft.; S.D.
Humble Oil & Ref. Co.'s No. 13 O'Connor, 933 ft. NE of No. 12 and 933 ft. NW of No. 11 on 5,545-acre tract in John Keating Sur. ..... T.D. 3,016 ft.; running tubing.
G. Jeffries' No. 1 James F. Power, 759 ft. from N and 1,512 ft. from E lines of 500-acre lease in J. J. Garza and J. Vidaurri Sur. ..... S.D. 1,010 ft.

SAN AUGUSTINE COUNTY

Fidelity Exploration Co.'s No. 1 Bryan & Flourney, 1,926 ft. from N and 725 ft. from E lines of Sec. 14, S.P.R.R. Sur. ..... T.D. 2,005 ft.; S.D. to clear title.

SAN JACINTO COUNTY

Darby Jones' No. 1 McBee ..... Sandy shale 2,862 ft.
Piedmont Oil Co.'s No. 2 Foster, 330 ft. each way out of NE cor. Geo. Taylor Sur. ..... Bldg. road; abnd.

VICTORIA COUNTY

C.R.&G. Drlg. Co.'s No. 1 R. C. Roos, 486 ft. from N line and 1,666 ft. from E line of tract in M. A. Castanon Sur. ..... T.D. 905 ft.; W.O.C.
Humble O. & R. Co.'s No. 1 Mitchell, 1,401 ft. from NE and NW lines of 5,000-acre tract in E. Benavides Sur. ..... Location.
Markle et al's No. 1 Dunlap, Manuel Zepeda Sur., 9,550 ft. along NW line of survey from most northerly NE cor. and 1,475 ft. SE at R/A ..... T.D. 2,850 ft., water sand; S.D.
Petrol Corp.'s No. 1 John Machalic, 1,330 ft. out of S cor. of 135-acre tract, Rafael Mancha Sur. ..... Set surface csg.
Wm. Quick's No. 1 Tom Joshua, 330 ft. out of NW cor. of Blk. 21, F. G. Hidalgo Sur. ..... Rigging up.
R. L. Shroyer's No. 1 C. Ross, 482 ft. from N line, 1,666 ft. from E line of 100-acre tract in M. A. Castanan Sur. ..... Moving in.
Texas Co.'s No. 8 McFaddin, A. J. Gray Sur., 6,600 ft. N of S line, 1,383 ft. from E line of NE cor. ..... Drlg. sand and shale 6,271 ft.

WALLER COUNTY

Amerada & Stanolind Oil & Gas Co.'s No. 1 Mary Manor, C of Sec. 93, Blk. 1, H.&T.C. Sur. ..... T.D. 1,167 ft.; W.O.C.
De Armand's No. 1 Vaughn, 1,200 ft. N of Kirby's No. 1 Vaughn, J. McFarland Sur. No. 46 ..... Derrick.

WHARTON COUNTY

Pure Oil Co.'s No. 1 W. Garrett, 4,456 ft. SE and 1,690 ft. NE of W cor. of Sec. 28 ..... T.D. 6,543 ft.; prep. to abandon.
Pure Oil Co.'s No. 2 Lancaster, 1,320 ft. NW of SE line and 1,476 ft. SW of NE line of tract in Sec. 23, Morris & Cummings Sur. ..... Drlg. shale 5,112 ft.
Pure Oil Co.'s No. 1 Stewart ..... T.D. 5,983 ft.; temp. abnd.
Pure Oil Co.'s No. 3 Stewart, Morris & Cummings Sur., Sec. 25, 990 ft. out of SW cor. of 160 acres ..... Drlg. shale 7,523 ft.
Pure Oil Co.'s No. 1 Wallace Houston, 858 ft. SE of NW line, 1,690 ft. NE of SW line, Sec. 28 (T. W. Heard Sur.) ..... T.D. 6,460 ft.; tested S.W.; pulling tubing; lost swab.

SOUTH LOUISIANA

ACADIA PARISH

Edwards Drlg. Co.'s No. 1 Daigle, NE cor. of SE of Sec. 24-7s-1e ..... Rigging up.
Rhodes Drlg. Co.'s No. 1 Latrell ..... S.D. 2,280 ft.
Superior Oil Co.'s No. 1 P. O. Hermandes, 990 ft. W. 990 ft. S of NE cor. SE Sec. 34-8s-3e ..... T.D. 8,916 ft.; perforation 7,845-50 ft.; flowing 31⅛ bbls. hour, 12/64-in. choke, 1,360 lbs. pressure.

AVOYELLES PARISH

Hass & Stokes' No. 1 Hass, from NE cor. SE Sec. 28 go along E line of Sec. 28 2,486 ft. to point on highway, thence 84° E on highway for 386 ft., thence N 87° E for 4,426 ft., then N 45° E 226 ft.... Rigging up.

BEAUREGARD PARISH

Humble Oil & Ref. Co.'s No. 1 Long Bell, 200 ft. E of W line and 2,640 ft. S of N line of Sec. 11-5s-7w .... Drlg. shale 8,796 ft.
F. W. Martin's No. 1 J. E. Cochran, SE cor. of NE of Sec. 34-4s-12w (W part of county and 6 miles S of Merryville) ..... T.D. 3,485 ft.; S.D.

CALCASIEU PARISH

Fred Oil Co.'s No. 1 Faizt, 566 ft. N, 300 ft. W of SE cor. of NW of SE Sec. 26-8s-10w ..... Gumbo 2,400 ft.; S.D.
Union Sulphur Co.'s No. 1 Barbe, 2,681 ft. W, 2,647 ft. S of NE cor. Sec. 1-9s-8w ..... Fishing; hard shale 8,125 ft.

IBERIA PARISH

T. D. Spell's No. 1 Bernard, 5,138 ft. SW cor. along western boundary line, then in NE direction 1,140 ft. along N line of Bernard land, 52 ft. S of well in Sec. 54-12s-7e ..... S.D. 2,850 ft.

JEFFERSON DAVIS PARISH

Shell Pet. Corp.'s No. 1 Kratzs, 660 ft. S, 330 ft. W of NE cor. NW Sec. 12-9s-4w ..... Drlg. brittle shale 8,508 ft.
Tide Water Oil Co.'s No. 1 Mrs. A. Bourgeosis, 250 ft. E and 205 ft. S of C of Sec. 28-9s-5w ..... Bldg. derrick, 7,000-ft. test.

LAFOURCHE PARISH

Southern Sulphur Corp.'s No. 1 D. L. Lagraize, 800 ft. E of NW cor. of Lot 7, thence 250 ft. S of Sec. 26-21s-22e ..... Spudded and S.D.

ST. BERNARD PARISH

Southern Sulphur Corp.'s No. 1 Lake Lery, 400 ft. W, 500 ft. N, SW cor. Sec. 28-13s-15e ..... Gumbo 2,867 ft.; S.D.

ST. LANDRY PARISH

Bailey Gaunce's No. 1 Lewis, 300 ft. N and E of SW cor. of NW of NE of Section 29-5s-6e (workover) ... T.D. 5,017 ft.; S.D.
H. H. Hotchins Lbr. Co.'s No. 1 Whiteman Lbr. Co., 250 ft. out of SW cor. NE Sec. 15-5s-6e ..... T.D. sand 3,936 ft.; S.D.

ST. MARTIN PARISH

Standard Oil Co. of Kansas' No. 1 E. B. Hopkins, Sec. 33-10s-6e ..... T.D. 7,963 ft.; S.D.
Texas Co.'s No. 6 St. Martin Land Co., 660 ft. S and 500 ft. W of NE cor. SE Sec. 17-8s-7 ..... Drlg. shale 3,596 ft.

ST. MARYS PARISH

Black et al and Edwards Drlg. Co.'s No. 1 Chetimanchs, Sec. 34-13s-9e, 219-acre tract approximately 500 ft. at right angles SE and SW lines of tract ..... Rigging up.

TERREBONNE PARISH

Texas Co.'s No. 1-B State-Bay Junop, 2,200 ft. N, 950 ft. E of SW cor. Sec. 27-21s-14e ..... Salt 6,625 ft., T.D.; P.B. 4,060 ft.; drlg. shale 4,101 ft.
Texas Co.'s No. 10 State-Caillou Island ..... Drlg. sand 6,049 ft.
Texas Co.'s No. 10 State-Dog Lake ..... Drlg. shale 1,136 ft.
Texas Co.'s No. 3 School Board, 2,630 ft. S and 1,384 ft. E of NW cor. of Sec. 16-22s-18w ..... Rigging up.

VERNON PARISH

Robt. K. Williams, Jr.'s No. 1 Llano Del Rio, 1,185 ft. S, 1,000 ft. W of NE cor. Sec. 7-1n-9w ..... Rigged up and S.D.

Wildcat Operations in Louisiana-Arkansas

(Continued from Page 180)

MOREHOUSE PARISH

Zeiger & Bacon's No. 1 Crossett, 400 ft. N, 300 ft. W, SE cor. Sec. 41-22-6e ..... S.D. 2,481 ft.

NATCHITOCHES PARISH

Penn Sou. Pet. Co., Inc.'s No. 1 Chopin Lbr. Co., 275 ft. N and W, SE cor. NE SW Sec. 4-5n-5w ..... Rigging up.

RED RIVER PARISH

Kincaid & Kelly's No. 1 Ober, 315 ft. N, 257 ft. W, SE cor. NW SE Sec. 5-14-10 ..... Set 10-in. 84 ft.
A. D. Mytiler's No. 1 La. Delta Pecan Co., 1,700 ft. N, 160 ft. E, SW cor. Sec. 27-13-11 ..... Set 8-in. 786 ft.
Oynett et al's No. 1 Thomas, 330 ft. S and E, C Sec. 34-13-8 ..... S.D. for fuel 740 ft.

SABINE PARISH

D. D. Alexander's No. 1 Brown est., 330 ft. N and E, SW cor. Sec. 9-9-11 ..... Drlg. 1,320 ft.
J. F. Anderson's No. 1 Burkett, 185 ft. N, 655 ft. E, SW cor. NW Sec. 10-9-13 ..... W.O.S.R. 1,993 ft.
J. W. Bettis et al's No. 1 Frost Lbr. Ind., 330 ft. S and W, NE cor. SW Sec. 15-9-13 ..... Rigging up.
R. B. Campbell et al's No. 1 Cook Land Co., 150 ft. N, 300 ft. W, SE cor. NW NW Sec. 35-10-12 ..... W.O. csg. 1,536 ft.
G. H. Collins' No. 3 Cranford, 330 ft. S and E, NW cor. SW SE Sec. 20-9-13 ..... Set 6-in. 1,461 ft.
Florence Oil Co.'s No. 5 Crawford, Sec. 30-9-13 ..... Comp. pumping 15 bbls., 1,975 ft.
Lula M. Layton's No. 2 Henderson, 330 ft. S and W, NE cor. NW NW Sec. 29-9-13 ..... W.O.S.R. 1,661 ft.
Zan Lloyd's No. 1 Henderson, 330 ft. N and W, C Sec. 29-9-13 ..... W.O.S.R. 2,031 ft.
H. C. Maulding's No. 2 Alford, 330 ft. N and E, SW cor. NW NW Sec. 18-7-10 ..... Bailing 2,750 ft.
Miles & Strickland's No. 1 McGee, 17 ft. S, 26 ft. E, NW cor. Lot 18, Sec. 9-9-13 ..... S.D. for fuel 950 ft.
John W. Moffett's No. 1 Logan Oil Co., Sec. 3-9-13 ..... W.O.S.R. 1,955 ft.
Sabine Royalties Co.'s No. 3 Graham, 330 ft. S and W, NE cor. SW NW Sec. 20-9-13 ..... Comp. pumping 15 bbls., 2,001 ft.
Parker et al's No. 1 Henderson, 330 ft. S and E, NW cor. SE NE Sec. 29-9-13 ..... Rigging up.
L. L. Posey's No. 3 Burkett, 330 ft. S and E, NW cor. NE NW Sec. 10-9-13 ..... W.O.S.R. 1,934 ft.
W. E. Rowe et al's No. 1 Craig, 330 ft. S and E of center Sec. 22-9-13 ..... S.D. 1,200 ft.
J. A. Stinson's No. 1 Whitney Corp., 330 ft. S and W, NE cor. Sec. 8-9-13 ..... W.O.S.R. 2,014 ft.
Stumpff & McFall's No. 1 Paul estate, Sec. 10-9-13 ..... Tested S.W.; S.O. 1,976 ft.
Windsor Oil Co.'s No. 2 Barr, 330 ft. N and E, SW cor. NW Sec. 15-9-13 ..... Location.

RAPIDES PARISH

Ben Banner's No. 1 Bentley Lbr. Co., 2,640 ft. E, NW cor. Sec. 11-4n-5w ..... S.D. 740 ft.
Evars & Collingsworth's No. 1 Hickman, 330 ft. S and E, NW cor. Sec. 40-4-1e ..... S.D. 2,130 ft.
J. C. Prine et al's No. 1 Baum, 600 ft. N and E, SW cor. NE SW Sec. 27-6n-2e ..... Dry and abd. 3,125 ft.

UNION PARISH

Ward & Jones' No. 1 Miller, 330 ft. S and E, NW cor. SW SW Sec. 16-21-2e ..... Coring 2,105 ft.

WEBSTER PARISH

I. G. Abney Oil Co.'s No. 1-B R. L. Slack, 330 ft. E, 660 ft. N, SW cor. SE Sec. 34-23-11 ..... W.O.S.R. 2,736 ft.

Arkansas

CONWAY COUNTY

Sou. Union Gas Co.'s No. 1 Feldman, C SW SW Sec. 6-5n-17w ..... W.O. 8¼-in. csg. 2,504 ft.

HEMPSTEAD COUNTY

A. H. Bagnelle's No. 1 Trattner & Rhinehart, Sec. 2-13-26. Drlg. 1,200 ft.

LAFAYETTE COUNTY

Douglas Lawn's No. 1 Camp, 330 ft. S and W, NE cor. SW SE Sec. 14-15-23 ..... Set 10-in. 52 ft.
George W. Harper's No. 2 Bodcaw, 150 ft. S, 550 ft. E NW cor. SW NW Sec. 16-15-23 ..... S.D. 1,216 ft.
C. V. Lenz' No. 1 Foster, 330 ft. S, 150 ft. E, C Sec. 9-15-25 ..... Drlg. 150 ft.

MILLER COUNTY

Duluth-Ark. Oil Co.'s No. 2 Beck, 330 ft. S and E, NW cor. SE SW Sec. 34-15-26 ..... Arranging to pump with jack 2,807 ft.
Fitzwater et al's No. 1 Norson, SW cor. SE SW Sec. 20-15-27 ..... S.D. 3,177 ft.
King Oil Corp.'s No. 1 C. H. Schroder, 300 ft. N, 330 ft. E, SW cor. SW NE Sec. 24-14-28 ..... Drlg. 1,830 ft.
C. E. Murdock's No. 1 E. L. Beck, 330 ft. N and E, SW cor. SE SE Sec. 33-15-26 ..... Set 10-in. 108 ft.
Frank Roe's No. 1 Olivet, NE cor. NE SE Sec. 4-16-26.. Set 10-in. 130 ft.
Texarkana Oil Corp.'s No. 1 H. E. Beck, 330 ft. N and E, SW cor. SW SW Sec. 34-15-26 ..... Coring 2,840 ft.
Lee Timberlake et al's No. 1 E. L. Beck, 150 ft. N and E, SW cor. NW SE Sec. 33-15-26 ..... W.O. csg. 60 ft.
J. K. Wadley's No. 1 Deckerman, 200 ft. N, 330 ft. E, SW cor. NW Sec. 24-17-27 ..... Set 10-in. 147 ft.; drlg. 1,594 ft.
E. L. Young, Tr.'s No. 1 Patterson, SE cor. SE NE Sec. 5-19-28 ..... S.D. 3,666 ft.; curing titles.

OUACHITA COUNTY

L. L. McDonald's No. 1 J. A. Robertson, 200 ft. S and E, NW cor. NE NW Sec. 25-15-16 ..... W.O.S.R. 2,092 ft.

UNION COUNTY

E. R. Henderson's No. 2 J. H. Ogden, 330 ft. S and E, NW cor. SW SE Sec. 32-18-14 ..... Arranging to use acid 2,208 ft.
E. R. Henderson's No. 1 Vines, 330 ft. N and W, SE cor. SW SE Sec. 29-18-14 ..... P.B. to 2,161 ft.
Mrs. R. K. Jones et al's No. 1 J. Davis, 330 ft. N and W, SE cor. NW NW Sec. 28-16-14 ..... Set 10-in. 120 ft.
Tubal Pet. Co.'s No. 1 Gaddy, 340 ft. N and E, SW cor. SE NW Sec. 14-17-14 ..... S.D.; W.O. 3,416 ft.

Mississippi

GREENE COUNTY

United Gas Public Service Co.'s No. 1 Davis, C NW Sec. 30-1n-5w ..... Drlg. 5,550 ft.

PIKE COUNTY

B. D. Findley et al's No. 1 State Bank, C SE Sec. 28-3n-7e ..... S.D. 3,050 ft.

SIMPSON COUNTY

Beavy Corp.'s No. 1 R. J. Beavy, C SW Sec. 24-2n-4e.. Set 6⅝-in. 2,325 ft.

WALTHALL COUNTY

Mutual O. & Gas Co.'s No. 1 Boyd, Sec. 34-2n-9e, SW cor. SW SE ..... Moving in rig.

WARREN COUNTY

Orbet Drlg. Co.'s No. 1 R. L. Parker, 300 ft. E. CWL, Sec. 14-14-1e ..... Reaming 3,169 ft.

Louisiana-Arkansas Proven Areas

North Louisiana

CADDO—RODESSA

Company, well, farm name, section and block—	Remarks:
R. W. Norton's No. 1-B J. B. French, 660 ft. S and E, NW cor., Sec. 34-23-16	Fishing for tubing 4,990 ft.; T.D. 6,717 ft.
United Gas Pub. Ser. Co.'s No. 1 Deer, 1,320 ft. N and W, SE cor. Sec. 24-23-16	Drlg. 3,891 ft.

SABINE PARISH—ZWOLLE

Alexander & Cane's No. 1 Fogman, SE cor. N½ SW NE Sec. 18-7-11 ..... Set 10-in. 40 ft.; drlg. 610 ft.
Dyer et al's No. 1 McCollister, 330 ft. S and E, NW cor. SW NE Sec. 24-7-12 ..... S.D. 1,100 ft.
E. D. Holcomb's No. 1 Porter, 330 ft. S, 330 ft. W, NE cor. SE Sec. 7-7-11 ..... Drlg. 1,766 ft.
M. J. Kissick's No. 1 Barr, 350 ft. S and W, NE cor. SW SE Sec. 6-4-11 ..... Coring 1,875 ft.
Magnolia Pet. Co.'s No. 2 Gindratt, 330 ft. N, 330 ft. E, SW cor. SE Sec. 30-8-11 ..... T.A. 2,485 ft.
Magnolia Pet. Co.'s No. 2 Peterson, 990 ft. S, 330 ft. E, NW cor. NE NE Sec. 10-7-11 ..... Comp. pumping 50 bbls., 2,748 ft.
Monroe Prod. Co.'s No. 4 Sabine Lbr. Co., 330 ft. N and E, SW cor. SE NW Sec. 7-7-11 ..... S.D. 2,505 ft.
Geo. L. Pace's No. 1 Garner, 330 ft. N and W, SE cor. SW NE Sec. 15-7-11 ..... Drlg. 1,340 ft.
Pelican Nat. Gas Co.'s No. 29 4-L Co., Sec. 29-8-11... Set 6-in. 2,285 ft.
Pelican Nat. Gas Co.'s No. 30 La. Long Leaf, 311 ft. S, 323 ft. W, NE cor. Sec. 31-8-11 ..... Set 10-in. 55 ft.; drlg. 314 ft.
Service Drlg. & Roy. Co.'s No. 1 Byrd, 400 ft. N, 500 ft. W, SE cor. SW NE Sec. 7-7-10 ..... Drlg. 2,150 ft.
Tex-La-Ark Oil Co.'s No. 1 Pickering Lbr. Co., Sec. 3-3-13 ..... S.D. 1,050 ft.; repair boiler.
Texas Co.'s No. 7 Stille, 330 ft. S, 330 ft. E, NW cor. SW Sec. ..... Rigging up.

SABINE PARISH—PLEASANT HILL

Bridges Co., Inc.'s No. 1 Moore, CEL NW NW Sec. 5-9-13 ..... S.D.; W.O. 2,130 ft.

Mississippi

RANKIN COUNTY

Benedum & Trees' No. 1 Southern Dev. Co., Sec. 35-4n-1e ..... Drlg. 6,335 ft.
Ferguson, Fuller & Metz' No. 1 Ammona, 350 ft. E and S, NW cor. NW NW Sec. 35-3n-3e ..... Partly rigged and S.D.

East Texas (Border Counties)

CASS COUNTY

R. K. Karnon et al's No. 1 Savage, Mary Patterson Sur... Drlg. 2,025 ft.

HARRISON COUNTY

R. C. Payne et al's No. 1 Lowery, E. D. Spain Sur. ..... Drlg. 3,697 ft.

PANOLA COUNTY

Acre & Rotunda's No. 1 Burnett Lbr. Co., J. H. Mallory Sur. ..... Drlg. 1,650 ft.
Givens & Holloway's No. 1 Wooten Est., Winnie Mann Sur. ..... S.D. 182 ft.
R. W. Price's No. 1 Crawford, J. A. Williams Sur. ..... Rigging up.

SHELBY COUNTY

Bush Oil Int.'s No. 1 Windham, W. M. Blackburn Sur... S.D. 3,366 ft.
Turner & Neil's No. 1 Pickering Lbr. Co., P. W. Harvey Sur. ..... Set 10-in. 65 ft.

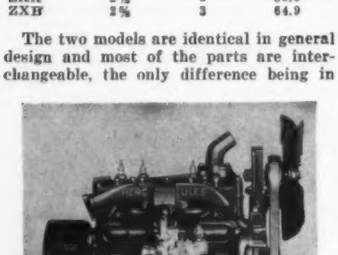
NEW AND IMPROVED EQUIPMENT

Hercules Adds Two New ZX Models to Its Engine Line

The Hercules Motors Corp. of Canton, Ohio, has added the following models to its line of ZX heavy-duty four and six-cylinder engines, thus giving a complete range of sizes of 4 to 200 horsepower:

Model	Bore	Stroke	Displacement
ZXA	2⅛	3	58.8
ZXB	2⅝	3	64.9

The two models are identical in general design and most of the parts are interchangeable, the only difference being in



the bore sizes and the parts affected thereby. The maximum torque of the ZXA is 37 pounds developed at 1,500 to 2,400 r.p.m., and on the ZXB is 40 pounds developed at 1,500 to 2,400 r.p.m. Both models peak at 4,000 r.p.m., the ZXA developing 22 horsepower and the ZXB 24½ horsepower at this speed.

To meet present-day operating conditions calling for sustained high speed, special consideration has been given to valve cooling. Standard practice includes thermo-siphon cooling, but water pumps are available if specified.

Lubrication is of the full force feed type to the main bearings and connecting-rod bearings. The pump is located beneath the center main bearing and driven from the camshaft by spiral gears. The shafts and gears of the oil pump are case-hardened, insuring long life to this unit. Oil pressure can be adjusted easily to suit operation requirements. The crankcase is cast integrally with the block. The pistons normally are of cast iron and carry three rings above the pin. The lower of these rings is of the oil regulating type. Aluminum pistons can be supplied.

The ZX series engines are for application where small engines are required in oil field apparatus, road-building machinery, etc.

The engines are available in the open type and completely inclosed type power units and can be equipped to operate on kerosene and natural gas as well as gasoline. Different types of power takeoffs, including stub shafts, clutch power takeoffs and reduction gears, are available.

SEVEN NEW MODELS ANNOUNCED

Addition of seven new models to the Marmon-Herrington line of all-wheel-drive trucks is announced by Bert Dingley, the company's vice president in charge of sales. Two of the new models are gasoline powered and five are equipped with Diesel engines. The Marmon-Herrington line now consists of five series of all-wheel-drive trucks and truck-tractors with a total of 28 different models ranging in capacity from 1½ tons upward. Seventeen gasoline-powered Marmon-Herringtons now are available to the buyers. The two new models in this division are the TH340-4, a four-wheel-drive unit with a capacity of 20 tons, and the TH340-6, a six-wheel-drive vehicle with a capacity of 35 tons.

Notes About Trade Literature

A 20-page booklet issued by Johns-Manville, 22 East Fortieth Street, New York, discusses Transite pressure pipe.

—

Worthington refrigeration compressors are the subject of a six-page illustrated bulletin available from the Worthington Pump & Machinery Corp., Harrison, N. J.

—

Any truck operator may obtain for the asking the 1934 edition of "Truck and Trailer Size and Weight Restrictions," a 56-page booklet issued by the Four Wheel Drive Auto Co., Clintonville, Wis. The laws for each state are arranged in alphabetical order for quick reference.

—

The Brown Instrument Co., Philadelphia, Pa., is offering a 32-page catalog featuring the Brown resistance thermometer for measuring temperatures from —300° F., to +1,000° F. Copies will be sent to industrial executives asking for Catalog No. 9,001.

—

The Link-Belt Co., 910 South Michigan Avenue, Chicago, has prepared a new general catalog of 1,024 pages. Equipment covered includes elevating and conveying chains, elevator buckets, sprocket wheels, chain drives and power transmission machinery.

—

Bulletin No. 306, mailed on request by the Quigley Co., 56 West Forty-fifth Street, New York, describes Q-Chrome superrefractory cement for laying firebrick and for protective surfacing over new or old furnace walls subject to extreme temperatures.

Fisher Governor and Smith Separator Unite in Display

The Fisher Governor Co., in conjunction with its Mid-Continent agents, the Smith Separator Corp., has established an interesting exhibit of Smith and Fisher products at the Smith Separator offices in Tulsa. This display room, 20 feet by 40 feet in size, is in the Chestnut & Smith Building at Seventh Street and Cheyenne Avenue.

Most of the members of the Purchasing Agents Association of Tulsa, with their assistants and many of their superiors in different oil companies, were guests last Thursday noon at a luncheon and inspection of the exhibit. T. K. Smith, president of the Smith Separator Co., headed the group of officers, salesmen and demonstrators for the company in greeting and entertaining the guests.

The exhibit of Smith Separator products includes the Waters gauge cocks or try cocks for boilers, a working model of the Smith separator, and a demonstration rack for operating the Smith Ever Ready tubing catcher. The Smith separator is provided with a glass front so that the interior may be seen. It is lighted by Neon lights, and has oil circulating through the separator so that the scrubbing action of the baffles, louvres, and mist extractors may be observed.

On the demonstration rack for the Smith Ever Ready tubing catcher, means is provided for raising and lowering this catcher, as well as manually tripping it to show its action in the hole in case the tubing parts. The catcher also may be demonstrated on this rack to show the method of anchoring the catcher in case it is to be locked in any fixed position.

The Fisher display material involves an investment of fully $10,000. Practically the entire line of automatic controlling specialties manufactured by the Fisher Governor Co. is represented. Each piece is attractively made up in polished and nickel-plated form, as well as being cut sectioned to show the internal construction and manner in which it operates.

AHT Pump Made to Handle Oils at High Temperature

The Cameron class AHT high-pressure centrifugal pump, described in Ingersoll-Rand Catalog No. 7065, was designed

for the sole purpose of handling the high temperature oils encountered in cracking-coil charging service.

The new catalog shows why this pump is able to withstand the high pressures, high temperatures and the corrosive and erosive action of the oils handled in the various refineries.

It is a 10-stage centrifugal pump, built to operate at pressures up to 1,250 pounds per square inch. Its casing is built like a gun barrel, with remarkable strength and precision. Extraordinary provisions are made to take care of expansion, leakage, lubrication, etc.

The pump is arranged for dual drive, eliminating the necessity for a standby unit.

Air Reduction Putting Two More Units on the Market

The Air Reduction Sales Co., 60 East Forty-second Street, New York, has added to its line of pantograph-type gas cutting machines two new units, designated as the Airco-DB No. 7 oxygraph and the Airco-DB No. 1 travograph, respectively, which enlarge the range and scope of machine gas cutting.

The basic principle of operation is the same as that of the Airco-DB No. 6 oxygraph. However, the No. 7 oxygraph employs a different pantograph construction, the fourth side of the parallelogram being removed to the rear. This arrangement allows the working ends of the arms to swing between the vertical posts which support the pantograph assembly, as well as in back of them, and permits the covering of a maximum cutting area with a given length of arms.

The No. 7 Oxygraph has no tracer bar, the tracer being attached to the end of one pantograph arm and the cutting torch to the end of the other arm. It is designed for single torch operation only. In this machine the tracing table for holding the full-scale drawing is part of the machine and is located on top of the bed between the vertical posts. Either a manually controlled or a magnetic tracer can be used.

In the case of the No. 1 travograph, the pantograph assembly is mounted on a carrier that travels on rails. This feature accounts for its greatly extended cutting area as compared with the No. 6 oxygraph in which the pantograph assembly is mounted on a heavy stationary base. Like the No. 6 oxygraph the No. 1 travograph is fitted with a long tracer bar, attached to the outer ends of the pantograph arms. The tracer mechanism and cutting torch holders are mounted on this bar and may be moved to any position along the bar and secured in place by setscrews. As many as six cutting torches may be mounted on the bar for multiple cutting. The cutting torch or torches, being mounted on the same

bar with the tracer, conform to the movement of the latter and cut a faithful reproduction of the path over which it travels. The No. 1 travograph can also be operated with either manually controlled or magnetic tracer.

New Kind of Temperature Regulator Is Introduced

Wilbin Instrument Corp., 40 East Thirty-fourth Street, New York, has placed on the market a line of electric temperature regulators of wide use in the oil industry and embodying interesting features. The line comprises automatic valves for steam, gas, oil, water or brine flow control, actuated by thermostats of various kinds.

Instead of the conventional rotary motor, a "heat motor" of advanced design is employed to operate the valve. This motor consists of a pressure chamber in

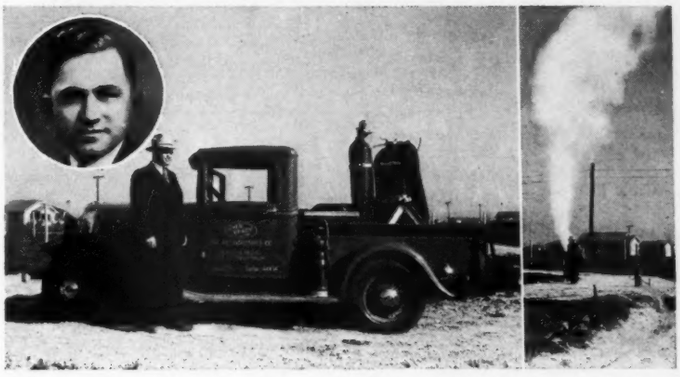
which a volatile fluid is vaporized by an electric strip heater. The vapor pressure thus built up compresses a flexible bellows in the the chamber. The valve plunger is attached to this bellows and is moved upwards when the bellows is compressed. Limit switches, actuated by the valve stem itself, control and reverse the valve stroke. An ingenious device for interrupting the electric circuit makes it possible to arrest the valve travel at any point between the "open" and "closed" positions. It is said that six different valve positions are obtainable for a total temperature difference at the thermostat of only 1° F. This makes possible extremely close control of temperatures even where fluctuations occur rapidly over wide limits.

According to the manufacturers, the new instruments are simple, inexpensive and easy to install and maintain. Combinations are available suitable for all process industries, refrigeration, air conditioning, weather and zone control of heating systems, oven and room control.

VARIABLE SPEED TRANSMISSION

A novel self-adjusting, positive variable speed transmission for fractional horsepower duty, known as the Link-Belt V.R.D. (variable roller drive), is announced by Link-Belt Co., Philadelphia, and Chicago, as a companion to its P.I.V. gear variable speed transmission announced five years ago for larger capacities. The V.R.D. is capable of 1½ horsepower output at maximum speed, with a maximum ratio of speed variation of 10 to 1, continues such features as compact all-metal construction, total enclosure, self-lubrication in an oil bath, protection from moisture and grit, and the use of a chain for transmitting the power positively. Novelty in the V.R.D. consists in the construction and application of the chain which is used for transmitting the power from input to output shaft. It is side-contact roller chain, consisting of steel links, made endless and connected by hardened steel pins in hardened steel joint bushings.

Extinguisher Uses Dry Chemical of Special Formula



The Ever Ready Fire Extinguisher Co., 1414 Austin Street, Houston, Tex., has been appointed exclusive Texas distributor of Ever Ready dry chemical fire extinguishers, manufactured by the Diener-Dugas Fire Extinguisher Corp., Chicago. The company has branch offices in Dallas and San Antonio. C. C. Swancy, well known in oil field circles, is sales manager.

Ever Ready dry chemical fire extinguishers are manufactured in sizes ranging from 350-pound wheel-type engines to 30-pound hand extinguishers. A dry chemical of special formula is used instead of a liquid. This chemical is expelled with great force against the flames by nitrogen gas, carried in a special cylinder accompanying each extinguisher. When the chemical comes in contact with the flames it is converted into a heavy blanket of CO_2 gas, which almost instantly extinguishes the blaze. The chemical is harmless and will not freeze, harden or cake, according to the manufacturer. The company is to give demonstrations at the International Petroleum Exposition in Tulsa.

In the accompanying illustration one of the Ever Ready Fire Extinguisher Co.'s demonstration trucks is shown. C. C. Swancy is standing beside the truck. The inset picture is of Lodias J. Dugas, originally from Louisiana, who invented the equipment. At the right, Mr. Swancy is shown making a demonstration of the efficiency of Ever Ready fire extinguishers. On this demonstration a major gas company laid a 2-inch line from one of its mains, turned on 150 pounds of pressure, and lighted the gas. Mr. Swancy extinguished this fire repeatedly in less than two seconds.

Newest Torsion Balance Is Designed for Fast Service

Following the trend towards speed and economy in geophysical prospecting, the American Askania Corp., Houston, Tex., has brought out a new torsion balance which has several distinct features.

The new balance is more compact. It consists mainly of two inclined balance beams (hung up through a torsion wire on a new type torsion head and reversed against each other through 180 degrees), which in their respective tubes have been mounted to a central cast-aluminum casing containing the optical equipment of the instrument. The period of observation is 20 minutes only.

All mirrors are easily accessible for any necessary adjustments, and so are the balance beams which, through glass windows in the inner aluminum tubes, can be checked visually in their full length, thus making the locating of any trouble in the instrument easily possible.

The plate clock used in other types of Askania torsion balances has been eliminated, the displacement of the dots on the photographic plate being possible through rotatable mirrors coupled with the rotation of the instrument. The new balance fits on any later type clock section and bell-shaped base of Askania torsion balances, and can be operated with full automatic recording or semi-automatically by hand.

Since the instrument is only about 4 feet high (center of gravity at 70 cm.), it can be set up in smaller field huts if desired and really can be operated by one man, the weight being 85 pounds for full automatic operation and 55 pounds for semiautomatic.

One station can be covered in 1 hour and 20 minutes, with four dots on the plate (three azimuths and one check). The sensitivity of the instrument is slightly smaller than that of the Askania Z-bar torsion balance.

The American Cyanamid Co. and the Pittsburgh Plate Glass Co. have formed the Southern Chemical Corp., with a Delaware charter, and have qualified to do business in Texas. The new corporation will produce a line of chemicals in connection with the operation of the alkali plant being constructed at Corpus Christi, Tex., by the Southern Alkali Corp., jointly owned by the two companies.

Men Well Known in the Equipment Field

A. W. Herrington, president and engineering head of the Marmon-Herrington Co., Indianapolis, Ind., has had close connection with the oil industry and is conversant with its transportation problems. He worked with officials of the Iraq Petroleum Co. in the pipe hauling operations involved in building the 1,-

A. W. HERRINGTON

200-mile pipe line across the Syrian desert. In addition to twice visiting the scene of operations and going over the entire pipe line project, he designed four special pipe hauling units which carried a total of 2,000,000 ton-miles of steel pipe, or one-sixth of the total necessary.

Mr. Herrington will be in charge of the Marmon-Herrington display at the International Petroleum Exposition, accompanied by Bert Dingley, vice president in charge of sales.

Hard Drilling Conditions Met by New Rotary Chain

An extra heavy all-alloy rotary chain, especially designed for severe drilling conditions, has been developed by the Standard Brake Lining Co. of Gleasondale, Mass.

All parts of Standco all-alloy chains are made of chrome nickel alloy steel, scientifically heat-treated to produce great strength and long service. The bushings and pins are press-fitted into the side bars. Rollers and bushings are seamless, being machined from solid bars. Cotter-pins are of solid type and made of heat-treated, high chrome nickel steel.

The No. 4 A.P.I. extra heavy Standco all-alloy chain weighs 16.5 pounds per foot and has an ultimate strength of 180,000 pounds. The No. 3 A.P.I. extra heavy Standco all-alloy chain weighs 8.3 pounds per foot and has an ultimate strength of 75,000 pounds.

The Standco chain is sold in the Mid-Continent territory by Snetcher & Pittman, Inc., Oklahoma City, and on the Pacific Coast by the Standard Brake Lining Co., through its district office, 1137 Venice Boulevard, Los Angeles, under the management of C. W. Hanslip.

Kansas Fields

(Continued from Page 179)

County, pumped an estimated 160 bbls. of oil and 25 bbls. of water in 24 hours from Siliceous lime at 3,260-80 feet, which had been acidized.

Barton County

Hilligoss and others completed No. 3 Isern, NW SE NE Section 12-20-11w, Barton County. It pumped 813 bbls. in a potential test, the oil coming from Siliceous lime at 3,306-11 feet, which had not been acidized.

Rice County

Continental Oil Co.'s No. 1 Wickesham, NW SW SE Section 7-20-9w, Rice County, had 2,400 feet of oil in the hole from Siliceous lime at 3,280-92 feet and was shut down for tankage.

Lario Oil & Gas Co.'s No. 1 Foote, SW cor. NE, Section 7-20-9w, filled up 1,800 feet with oil from Siliceous lime at 3,278-93 feet and swabbed 8 bbls. per hour. It will be acidized.

The Texas Co.'s No. 1 McFarland, NE SE SW Section 7-20-9w, took another potential gauge and made 1,031 bbls. on the pump in 24 hours producing from Siliceous lime at 3,275-91 feet, which had been acidized.

Gypsy Oil Co.'s No. 1 E. Malone, SW cor. NE, Section 18-20-9w, had Siliceous lime at 3,329-49 feet and swabbed 100 bbls. of oil and 5 bbls. of water in 11 hours.

Gypsy Oil Co.'s No. 1 Steckel, C W half SW NE Section 31-19-10w, had Siliceous lime pay at 3,329-32 feet and swabbed 2 bbls. per hour. It will be acidized.

National Refining Co.'s No. 3 Sherman, NE SE SW Section 16-19-9w, swabbed 115 bbls. in 16 hours from conglomerate at 3,187-99 feet, total depth 3,245 feet.

Gypsy Oil Co.'s No. 2 Rife, 270 feet north and 868 feet east of SW cor. Section 32-19-9w, had Siliceous lime at 3,241-68 feet and the hole filled 1,600 feet with oil in 16 hours.

Empire Oil & Refining Co. made a location for No. 1 Proffitt, NW SE SE Section 6-20-9w. Gypsy Oil Co. made a location for No. 4 Christopher, NE NW NE Section 6-20-9w, and had rig on the ground for No. 5 Christopher, NE SE NE Section 6. Continental Oil Co. made a location for No. 2 Wickesham, SW cor. SE Section 6-20-9w. Gypsy Oil Co. had rig up for No. 4 M. H. Malone, NE cor. NW Section 18-20-9w. National Refining Co. made a location for No. 4 Sherman, SW SE SW Section 16-19-9w. Magnolia Petroleum Co. had cellar dug for No. 1 Beyers, NE NW NW Section 20-19-9w.

Sedgwick County

Magnolia Petroleum Co. completed No. 2 Vickers, SW NW NW Section 20-27-2e, Sedgwick County. It is a 35-bbl. pumper, with about 12 bbls. of water per day from chat at 2,923-60 feet.

Butler County

Cromwell & Lewis were drilling at 1,865 feet in No. 4 Stern, NE SW SE SE Section 28-27-6, Butler County, and H. H. Patten had machine in for No. 4 Schriver, C S half SE Section 33-27-6. Harry Gore and others spudded No. 5 Young, SE NW NW Section 27-26-7.

Stafford County

Atlantic Oil Producing Co. completed No. 1 Gates-B, C SW NE Section 27-21-13w, Stafford County. It pumped 105 bbls. in 24 hours in a potential test. It had been acidized at 3,689-95 feet.

Vickers Petroleum Co. and Phillips Petroleum Co.'s No. 1 Cravens, a wildcat in the SW cor. NE Section 15-25-11w, Stafford County, which came in the first part of April at 304 bbls. per day, with 39 bbls. of water, from Viola lime at 3,920-24 feet, was given a 1,000-gallon acid treatment but had not been tested when this report was made.

Greenwood County

Franco-Central Oil Co. and Lassen and others have machine rigged up for No. 9 Wilkinson, NE NW SE SW Section 6-25-9, Greenwood County. Polhamus & Smith were drilling at 425 feet in No. 1 Sample, C S half S half SE Section 35-25-10. Landon and others have machine in for No. 9 Smith, SE NW NW Section 8-24-12. Frank Young was drilling at 300 feet in No. 1 Burris, SE SW cor. Section 20-23-13. Slick, Pryor & Lockhart have made a location for No. 1 Leedy, SW cor. NE Section 25-22-9.

Wage Rate Fluctuations Hit by Jersey Company

After four years of bad news in most business reports, it is cheering to read of wage increases made in some of the leading industries, says The Lamp, official publication of the Standard Oil Co. (New Jersey). This is definite indication that recovery is taking place. Higher hourly rates in the steel and automobile plants stimulate other industries to a study of their own wage situations.

Purchasing power would have been accelerated and much privation avoided had hourly wage rates been held steady during the depression, the company says. It points out that it has made no rate slashes itself, while most other large employers revised their schedules downward. Standard of Jersey employes are earning only 16.7 per cent less than in December, 1929, compared with a drop in the cost of living of 21 per cent.

"Standard Oil Co. (New Jersey) has been working on the theory," the company says, "that more consideration should be given to the employes' desire for regular work. At least in the consumer goods industries, it seems that violent fluctuations in the hourly wage rates might be reduced by more even spacing of production activities. If working hours are varied in keeping with the expansion or contraction of demand, unemployment is reduced, purchasing power spread more evenly and normal conditions restored more quickly when business picks up."

In discussing Senator Wagner's industrial disputes bill the Jersey company says the measure was not well designed to cement harmonious relations throughout industries generally.

"While it contained many good features," says the company, "it appeared to be predicated on the assumption that all voluntary collective bargaining arrangements between employer and employe outside of organized labor unions are 'company unions.' This has become a term of opprobrium to mean a device created by the employer to hookwink the worker.

More than 16 years ago the company inaugurated a labor policy which afforded employes a method of collective bargaining, without discrimination on account of membership or nonmembership in any church, society, fraternity or union. That employes of the company and its domestic subsidiaries are satisfied with their working conditions, says The Lamp, is indicated by the fact that for 1933 the annual labor turnover or separation rate for all causes was only 21.1 per cent of the average force, while voluntary resignations were at the rate of only 2.3 per cent.

Comparable figures reported by the U. S. Department of Labor for 148 manufacturing industries showed a total separation rate of 44.7 per cent and a quit rate of 10.1 per cent per annum. The company's permanent lay-off rate for 1933 was at the rate of only 4 per cent per annum, the lowest in the recorded experience of the company.

HOUSTON PETROLEUM CLUB

HOUSTON, Tex., May 7.—With its sole purpose to bring together the personnel of the various oil companies of Houston into more intimate social contact, an organization, known as the Petroleum Club, has been formed here. The preliminary plans for the club are being directed by F. P. Delcuze of the Gulf Production Co. The club will sponsor regular and special parties, dances and other entertainment and recreational features for the members. The first dance, open to all prospective members, is scheduled for May 19.

SUPERIOR TO HOUSTON

The Superior Oil Co. of California will move its Texas headquarters from Dallas to Houston where it will have offices in the Gulf Building. About 50 men and women will be employed in the Houston office. The Superior Oil Co. of California is a crude producer, natural gasoline manufacturer and natural gas producer. The home headquarters are in Los Angeles, Calif.

H. L. MEREDITH DIES

SAN ANTONIO, Tex., May 7.—H. L. Meredith, sales representative of the Hughes Tool Co. in Southwest Texas, with headquarters in San Antonio, died at his home Friday. Mr. Meredith had been associated with the Hughes Tool Co. for 14 years, and was well known by oil men in this section.

CONSOLIDATED ROYALTY OIL

Report of Consolidated Royalty Oil Co. and subsidiaries for year ended December 31, 1933, certified by independent auditors, shows net income of $49,638 after taxes, depreciation, depletion, minority interest, etc., equivalent to 9 cents a share (par $10) on 552,925 shares of capital stock. In 1932 the company reported profit of $153,659 after expenses, taxes, etc., but before depreciation and depletion.

NEW JERSEY EMPLOYES STOCK

NEW YORK, May 7.—Standard Oil Co. (New Jersey) will continue to acquire stock in the open market for allotment to employes in accordance with the plan in effect during the past few years, it was explained in connection with the proposed vote of stockholders at the annual meeting on the fifth stock acquisition plan.

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